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The American Electrical Situation.

WHEN we are disposed to cast envious glances across the Atlantic at the immensity of American electrical industry, with a greater home market than any other country possesses, with vaster productive works, factories and power systems, with a much belauded consumption of electricity per head and everything else on the "big" side, we do well to remember that the biggest thing is not necessarily the healthiest or the most prosperous thing.

It is possible for an industry to be of such unwieldly proportions that it finds self-control or unity of control an extremely difficult matter to secure. Indeed, it is more than possible—it is an actual fact—that American electrical industry is in an absolutely chaotic state without any semblance of harmony or unity, if we are to judge from statements made at a September conference of the National Electrical Manufacturers' Association in New York.

From three papers read at that conference we need not select more than one to show what the situation actually is, and we cannot do better than quote the characteristically blunt and frank expressions which were used to call a spade a spade. Mr. W. E. Sprackling, for instance, in unfolding a plan for co-operative market development in a business which "is going through an interesting period of transition," finds failure at the sales end of that business. Production has now exceeded demand, the power companies are wondering where their increased load is coming from, the contractor is worrying just when he is going to get his next job, and over-production has brought the manufacturer "a competitive condition that within the past year has grown to be deplorable and vicious." Perhaps from the exaggeration and splash that appear in some of the United States papers, we have credited our American cousins with leading the world in that particular ability that they term "merchandising," but Mr. Sprackling demands that they shall develop a sense of

merchandising that will remove the blindfold from their eyes and show them that they have a selling job to do, and develop in them the ability and courage to go out and do it! "So far," the four groups in the industry "haven't had sense enough to get together. . . . We know little of the other fellow's problems and care less. . . . We have each been playing our own tune on our own fiddle in our own independent way so that the result has been one grand discord." The speaker laid it down that they must get away from their selfish, self-centred attitude, wrapped up in their own petty problems, and see that their problems were "the other fellow's problems too." He asked: "Can there be any real co-operative work done if there is suspicion or jealousy between divisions, between sections of divisions, or between the members of the sections?" Over-production is stated to be so great, competitive conditions so abominable, prices so ridiculous, "we are so busy selling our goods at a loss and calling each other liars," that the word co-operation is unknown and constructive merchandising is "an art that never existed." Putting down a heavy foot, it is declared that this attitude must be changed—there must be co-operation within each group and co-ordination between the groups.

All of this is extremely interesting and illuminating, yet it was only the preliminary part of a paper in which Mr. Sprackling tried to elaborate a plan for making more work for American electrical industry. It reads somewhat like our own W.O.B. campaign, but a year after the fair. For instance, it is found that out of 18,000,000 homes within reach of central station lines, 16,000,000 are already wired, leaving the discouraging figure of a mere 2,000,000 prospects; but, on the other hand, of the 16,000,000 wired homes, only 15 per cent. are adequately wired, leaving 13,000,000 that need more outlets and more fixtures, "and so we come to the job that has got to be put thru! . . . . We have got to start in on a plan of co-operative market development in which everyone in this industry has got to join hands and go ahead together." Comparing the electrical industry with other industries, he told his hearers that they must first realise that in merchandising they had been, and still were for that matter, "sound asleep"! But we go on finding enlightenment the further we read, for we learn that in the States "in building a house the last thing thought of is the electric wiring and fixtures." After all luxuries and necessities are arranged for, "the poor old electrical folks take what is left." Other industries have found that co-operative market development "pays, and pays big"; therefore, "for goodness' sake let us realise our backwardness, follow in their footsteps, and start some fireworks for ourselves."

Now what in downright reality is it that Mr. Sprackling is leading up to? In brief, it is the provision of a big fund for the Society of Electrical Development which has been reorganised for doing better work, so that it may carry on an intensive and widespread educational work, advertise the advantages of electricity, and in various ways spend a million dollars a year on its operations. That Society, as many of our readers are aware, has been in existence for many years. It carried on enterprising campaigns year after year, and did really good work long before the British Electrical Development Association was set up for similar work on this side of the Atlantic. Presumably its funds and its operations have not grown with the increase in the size of the American industry—orders have been coming in for the asking in all branches, manufacturers, contractors, jobbers and electricity suppliers, but now that there is not the same activity and prosperity and there are more people in the trade to take their share of what is going, something has got to be done, and co-operation between all the sections which are now at loggerheads is one of the things needed in order to send the Society out on a grand scale campaign at a million dollars a year for five years. This is the plan of co-operative market development that is advocated as a means of bringing back prosperous activity to the immense electrical industry which Mr. Sprackling indicated as being in a deplorable and vicious competitive condition, with its personnel full of suspicion and jealousy selling goods at a loss and "calling each other liars." There was a time when some parts of this indictment were applied by some observers of British electrical industry—some of the words are strangely familiar. The most interesting part of the matter is the improved atmosphere in the United Kingdom at the very moment when our wealthy cousins are creating discordant music upon multitudinous fiddles.

The Circles Campaign Opened.

The Circles Campaign had a good send-off in London on Monday under the presidency of Sir James Devonshire, president of the British Electrical Development Association. Sir James also issued a National Message, which was read at the provincial luncheons on the same day; this we reprint on a later page. In his speech at the London luncheon, Sir James, after thanking the Press for help thus far rendered to the cause of national electrification, suggested that it was because of the important part played by electricity during the war that the nation became really interested in it. Then the industry which had long been too modest and retiring began to take advantage of the opportunity thus created for extending electrical business, and E.D.A. was formed to engage in educative advertising to the general public and to stimulate enthusiasm within the industry itself. Last year's Better Lighting Campaign brought on a record number of new consumers throughout the country, and led to improved illumination for many existing users. This time we have begun a national campaign, having a wider scope, namely, the Electrification of the Home. In the course of his speech, Sir James made suitable reference to the high pitch of technical excellence which had been reached by our electricity undertakings, adding that while commercially these undertakings were not so advanced as they might be, we were now all rapidly awakening to the meaning of the term "Service." The new idea of the electrical engineer is that duty to the public never ends at all; it should provide a reasonably cheap and thoroughly reliable supply of electric power by day and night, teach people of every class how best to use electricity with economy for all purposes; help them to get their buildings wired or acquire apparatus and maintain it in order for them. In carrying out the re-organisation that would follow upon the three Acts of Parliament passed since the war, the duty of actually distributing or retailing electricity had been left in the hands of the local undertakings already in possession of statutory powers. Undertakings which would be relieved of the task of generating were left "the far bigger and more responsible duty" of retailing power and educating the public. Sir James said that he was convinced that the benefits the trade would get out of the Circle Campaign would be measured by the help and effort that they put into it. His final sentences called for "positive action" on the part of distributors and others, also for a generous policy in dealing with those who conducted electrical businesses of any kind within their territory. The adoption of a positive and forward commercial attitude in the whole business could not fail to justify itself and be of enormous local benefit, while at the same time it would strengthen a very important section of our engineering export business.

We commend the present Campaign as deserving of the cordial support of everybody electrical—an investment which will yield a return of one hundred per cent.

Mr. Vyle on the Industrial Situation.

A comprehensive review of the British trade and industrial situation and the outstanding influences that are affecting it was given by Mr. Gilbert Vyle, who presided at the meeting of the Association of British Chambers of Commerce last week. Close students of the course of events during the

past eighteen months will join with him in welcoming the signs of a nearer approach to reasonableness in industrial relations. If they remember the futility of the nationally-called conference held at Westminster after the war, they will also approve of his attitude when he receives quite coldly the proposal that representatives of all the industries, and some other people, should again be summoned to consider questions bearing on industrial co-operation. An infinitely better plan is for individual industries which know their own affairs to settle matters amongst themselves. Each separate industry is a highly technical profession, and each has its own peculiar difficulties, the proper settlement of which cannot possibly result from outside interference, however well-intentioned. The better industrial atmosphere helps toward general stability, of course, and Mr. Vyle indicated that it would be helpful to traders if the Government removed without any further delay the uncertainty with which it had enveloped the Department of Overseas Trade. He felt sure that the Chancellor of the Exchequer must by now be convinced that the hasty proposal to interfere with the Department was uneconomical and contrary to public policy, and in view of the uncertainty in which the business man depending upon the Department was left, the Chambers have, we think quite rightly, asked for a definite pronouncement at an early opportunity.

Two other matters mentioned by Mr. Vyle call for continued attention. One is the serious effect of anti-British propaganda, sometimes by foreigners—which we can understand and even excuse—but sometimes by our own statesmen and other writers, who commit the incomprehensible and unpardonable sin of writing down in the foreign Press the race to which they belong and representing us as a people down and out. Those who had first-hand knowledge of the crushing effect of the war upon our trade should be the last to use their political name and influence to our detriment. They should have been the first to sink their political prejudices and lend their aid to the work of recovery. The other is the handicap that continuous high taxation—national and local—is to our industries, acting as a deterrent to enterprise and a retarding influence on trade recovery. The present very heavy taxes on businesses prevent low-price production, and those on the private person restrict his purchasing power for many classes of goods which if he could afford to buy them would soon revive industry, reduce unemployment, and cut down out-of-work payments.

The Radio Exhibition.

The National Radio Exhibition held in London last week was another milestone of progress in the science of broadcast radio-telephony. This show has become an assured annual celebration of the achievements of the youngest of the industries, which has grown to remarkable dimensions in five short years' time.

This season's exhibition was the sixth display of radio-telephone apparatus to be staged in the metropolis, and was of undoubted technical merit. It will probably surprise many to learn that £15,000 was expended on the organisation of the show, and the Exhibitions Committee of the Radio Manufacturers' Association is to be congratulated upon the fruits of its efforts. Whilst perhaps not so cheap at first sight as some foreign products, the modern British-made receiver is an instrument of worth, rationally designed and capable of reproducing both speech and music of a quality far superior to its predecessor of 12 months ago. Loud-speaker design has progressed materially, and a large percentage of the receiving outfits exhibited this year had incorporated in them battery "eliminators" for deriving the necessary operating power from the domestic electricity mains. Appearance, too, has received its due share of consideration: so much so, in fact, that it is no longer necessary to disguise the receiver, modern models being handsome pieces of furniture—in more than one sense—for such instruments are now classified as "furniture" for transport on British railways.

Without doubt this season opens with considerable promise: not only has the purchaser a wider choice of high-class instruments, including several excellent really portable self-contained outfits, but he will also obtain far better value for his money than he would have been able to do a few months ago. The wireless broadcasting service has become a public service as necessary to our daily life as any of the others: whilst appreciating the genuine experimenter's need of a scientific instrument, it is to be hoped that the opportunity of selling entertainment to the public at large will be made the most of. A more vigorous effort in merchandising would be opportune, and in this connection the royalty concession on behalf of Marconi's Wireless Telegraph Co., Ltd., which is referred to in our "Radio Notes" column, should be of some assistance by way of inducing users of out-of-date sets to invest in modern instruments.

The South-East England Scheme.

The second national electricity scheme prepared by the Electricity Commissioners and "transmitted" by them to the Central Electricity Board since the latter commenced to function was published on Tuesday, this week. It deals with the South-East of England, the area delimited being of about 8,828 square miles, embracing eleven counties and parts of three others, which together support a population of 11,392,561 people, according to the last census.

The district is of considerable importance, not only because it includes the densely populated metropolitan area and a considerable number of residential towns in the suburbs and on the sea coast, but also because it covers the industrial areas on both banks of the River Thames and the London docks; moreover, the potential coal-fields in Kent as well as wide strips of rural and agricultural territory come within its scope, and it was reassuring to hear the chairman of the Electricity Commission emphasise the fact that if the public wants cheap energy it must permit the erection of overhead-line towers. It is of interest, too, to note that some of the underground cable lines may be designed for an operating pressure of 132,000 volts between phases.

The 165 authorised undertakers in the area dealt with own, between them, 135 generating stations; the consumption of electricity is now about 112 kWh per annum per head of the population, and it is estimated will increase to 426 kWh in 1940-41. The outline of the scheme which will be found elsewhere in this issue indicates that, ultimately, this load is to be carried by 18 capital stations, namely, 13 existing ones, two already projected, and 3 new ones; the ultimate reduction of the 51 per cent. of spare plant declared to be carried at present to 12 per cent. is aimed at by the Commission, which is regarded as an important economic factor in the cost of production. The interconnection of stations is estimated to result in the release for revenue-earning purposes of about 245,175 kW of plant now said to be spare, and representing £3,700,000 of capital.

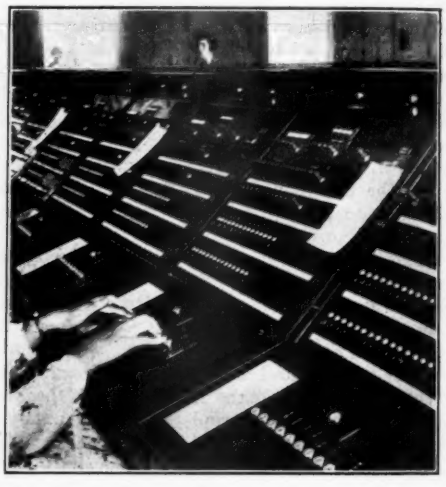
The cost of the scheme to the Central Electricity Board is estimated at £6,500,000, in addition to the expenditure of £5,500,000 by the owners of generating stations on extensions, &c.; the cost of the work it is proposed the London and Home Counties Joint Electricity Authority shall carry out in that portion of the area for which it is responsible will cost £2,000,000. It is contemplated that the Central Electricity Board should be in a position to commence to supply electricity in August, 1928, and the estimated saving five years thereafter will amount to £5,000,000 on generation alone.

In 1926-27 some 1,516 million kWh of energy was sold in the area under consideration, representing a revenue of £14,000,000, for which the average price obtained was 2.2d. per kWh. It is to be hoped that the operation of the scheme outlined will at least result in the reduction of the average, although the economies foreshadowed do not approach those that were expected. The Central Electricity Board will fortunately not need to undertake any frequency standardisation in this district.

A Tandem Telephone Exchange.

A brief description of the mechanical tandem exchange at Holborn, which is now in service, and marks the first stage in the conversion of the Greater London telephone system from manual to automatic switching.

A MECHANICAL tandem telephone exchange was recently commissioned by the Post Office authorities and is being utilised for the semi-automatic transfer of calls between various existing manual exchanges in the London area, and is the heart of the entire network. Situated in High Holborn, in the same building as the new Holborn main automatic exchange which will shortly be cut into service, the former is dealing with manual traffic only, pending the opening of the latter.



Figs. 1 and 2.—The Holborn Mechanical Tandem Exchange, Semi "B" Positions.

The Holborn tandem exchange comprises 108 cordless "B" positions, arranged in suites of squat switchboards (figs. 1 and 2), with sloping shelves mounting rows of numbered and lettered keys resembling those of a typewriter. The notation of the keys corresponds with that of the calling dials on the new London automatic telephones, the numerals 0 to 9 and the letters of the alphabet in groups of three being represented by individual keys. Associated with these switchboards, but accommodated on the floor below are 170 "senders" (fig. 3), the electro-mechanical equipment which responds to the manipulation of the keys by the tandem operators and sends out trains of impulses which register on the coder call-indicators at the outlying exchanges.

There are 73 manual exchanges within a radius of 10 miles of Oxford Circus, all of which have recently been equipped with coder call-indicator apparatus for the purpose of speeding up inter-manual exchange connections, and also for facilitating intercommunication between manual and automatic offices; twenty of these equipments are already in commission, and it is expected that the remaining 53 will be brought into use at an early date. The exchanges between which junction traffic is now being handled *via* mechanical tandem number 20. At each of them "B" operators' positions ranging in number from 1 to 5 have been equipped with coder call indicators for registering the instructions sent out from mechanical tandem, and enabling the local operators to complete the connections with the wanted subscribers' lines.

So far as the operators are concerned, the coder call-indicator comprises an illuminated display panel, let into the keyboards in front of them, and consisting of a ground-glass screen beneath which is a bank of miniature lamps, a numbered stencil screen being interposed between each lamp and the ground glass (fig. 2). Thus, by suitably controlling the illumination of selected lamps in the bank, a wanted subscriber's number can be displayed in luminous stencil on the ground glass, and all the operator has to do is to pick up any plug from the shelf in front of her and insert it in the corresponding jack, thereby completing the connection and automatically ringing the wanted subscriber's bell. For instance, when a Barnet subscriber asks for an Ilford number, the Barnet operator passes the instruction to a tandem operator, who immediately spells out the required Ilford number on her keyboard, thereby displaying that number before the Ilford operator, who completes the connection as described above.

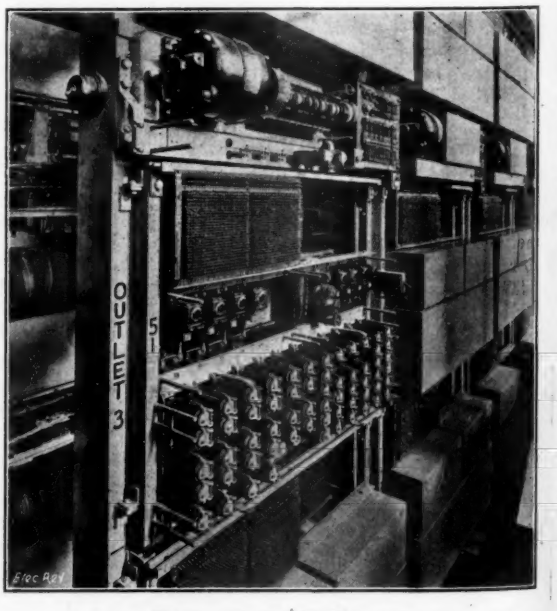


Fig. 3.—"Sender" Equipment.

It will be noted from fig. 4 that the verbal instructions are confined to one operator only in the case of mechanical tandem routing, whereas two, three, or even more, operators have to repeat the instructions under the purely manual system. The new method of working will therefore be considerably less liable to errors and also materially quicker, not merely because of the elimination of several intermediate operators, but also because of the inherent high speed of the electro-mechanical apparatus now employed. This increase in the speed of working will improve the efficiency of the junctions generally and lead to considerable economies in junction-line equipment between the various exchanges constituting the Greater London telephone network. Mechanical tandem operation will also effect still further economies in junction plant, as will be realised by comparing figs. 5 and 6; the complexity of inter-office cables in an hypothetical exchange network provided with direct trunking between all exchanges is indicated by fig. 5, whilst the simplification due to the introduction of a mechanical tandem exchange is revealed by fig. 6. Under the new scheme, the routes will be less diversified and will therefore be less costly in the first place and cheaper to maintain.

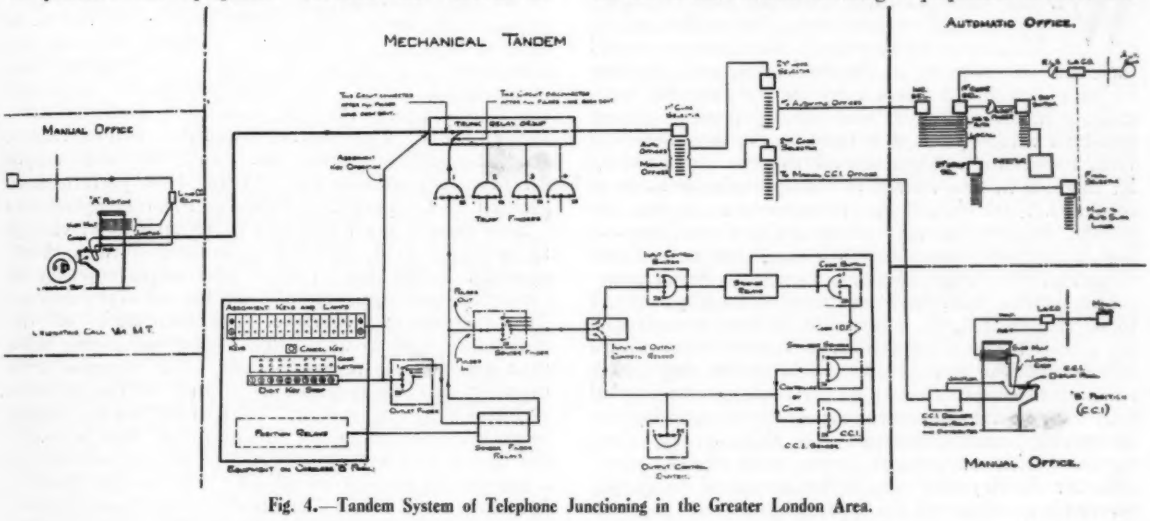


Fig. 4.—Tandem System of Telephone Junctioning in the Greater London Area.

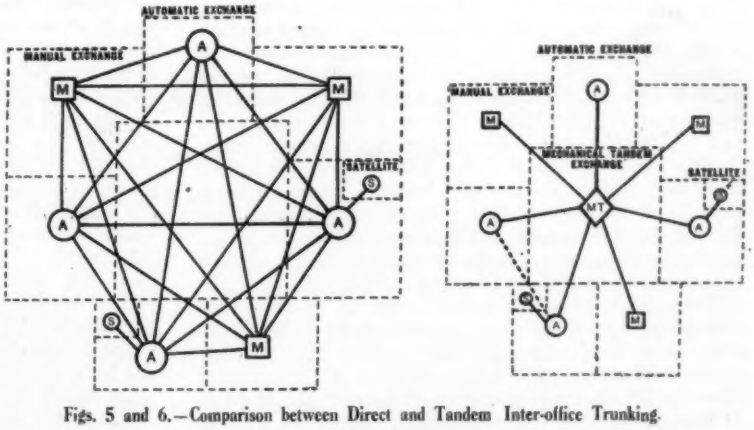
The instructions from the local operators to those operating the key-sending equipment at the mechanical tandem exchange are communicated *via* "order wires," these circuits being entirely separate and distinct from the "junctions" proper which make up the composite connections between subscribers located in different parts of the London area.

When the new London automatic exchanges are presently put into commission, the mechanical tandem equipment will perform the additional function of connecting manual exchange subscribers with those whose telephones and exchange apparatus have already been converted to automatic switching. In such cases the manual subscriber will instruct his local operator in the usual way, and the operator will pass the instruction *via* an order wire to a mechanical tandem operator who, by manipulating her keys, will send out the trains of impulses which actuate the Strowger selecting mechanism at the automatic exchange wherein the wanted subscriber's line terminates. In this case again there will be a considerable saving of time and greater accuracy, as compared with the older purely manual system, and corresponding economy in junction-line equipment.

From the foregoing it will be appreciated that the Holborn mechanical tandem exchange is, in fact, a telephone clearing house for the junction traffic of Greater London and that, whilst its primary functions are to speed up the older system and to effect inter-communication between the manual and automatic exchanges during the necessarily prolonged period of transition, it will eventually function as a routing centre for traffic between automatic exchanges. Although the full benefits of the change will not be apparent to subscribers until the automatic programme of the Post Office Telephone Department is completed, certain advantages will accrue almost immediately, and there will be a gradual, but marked, acceleration of the service as the various exchange equipments are cut into service and the director register controller, constituting the principal feature of the new London automatic system, gets into its stride.

The following is a list of the exchanges in and around London between which traffic is now being handled *via* the new mechanical tandem exchange:—

Addiscombe	Ilford
Albert Dock	Maryland
Barnet	Mill Hill
Buckhurst	Mount View
Clissold	North
Croydon	Palmer's Green
East	Thornton Heath
Enfield	Tottenham
Finchley	Walthamstow
Grangewood	Wanstead



Figs. 5 and 6.—Comparison between Direct and Tandem Inter-office Trunking.

The whole of the equipment of the tandem exchange, as well as the coder call-indicator equipment at 73 outlying manual exchanges, has been manufactured by the Automatic Telephone Manufacturing Co., Ltd., at Liverpool, and installed by it for the British Post Office, to whose engineers belongs the credit of having adapted mechanical tandem principles to the somewhat complex requirements of the London telephone service.

Power Transmission Lines.

Some Aspects of their Design: Assumptions and Limiting Factors for Extra-High-Voltage Operation.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

WE are about to start "extra" h.p. overhead power transmission development involving (in the case of the Central Scotland scheme alone*) some 256 circuit-miles of 132,000-V line, and, in some respects, this should create a new field of electrical engineering in this country. The voltage chosen is a good standard value—perhaps a little on the low side—and from its choice it might appear that we are avoiding an increase in line voltage to the approximate limit of corona, *i.e.*, the critical size of conductor for corona formation; this may or may not be a wise choice, depending on the initial transmission system, design, and construction. The transmission system is to be an interconnected one, and therefore large blocks of power are to be transmitted, in which case at least two circuits are needed for more reliability, so that in case of failure any one of the two circuits should be of ample kVA capacity to supply at least 30 per cent. greater normal load with the aid of synchronous condenser capacity and at normal generator voltage. As this country is not favoured with much water power, what there is available for development should be harnessed to supply power (at constant full load, every hour in the year for all years) into the interconnected system; such hydro-electric plant could be automatic stations, and the steam-electric stations could at all times take care of load fluctuations; in this way maximum use is made of water power.

In the location of a line, apart from applying common sense, there are the principles of engineering, and Post Office requirements and wayleaves should be commensurate with the importance of the service which is to be rendered to the general public. In the past it was (and to-day it is) necessary to aim at the safest line conditions, and, to do so properly, the least costly, &c., should be moved out of the way no matter who came there first, which latter has nothing to do with benefits to the public, whom both serve but not to the same relative importance, for, no matter how many communication circuits are on a pole, their relative public value and benefits fade into insignificance as compared with a power line supplying a city's industries; also on the score of relative public value, that utility which is of least value to the public, and is least costly, should always be subordinate, failing which the cost of design and construction will be increased and security from hazards made doubtful in spite of the increased unnecessary costs imposed as, for instance, the result of breaking the best principles of engineering and/or opposing crossings, &c., which were actually created and in most cases obtained gratis.

Very careful reconnaissance work is necessary to determine the best location of main power transmission lines, and their proper location becomes an economic problem of great importance. Before a transmission line can be designed, we must first know the location of the receiver and generating stations, as well as the transmission distance and the load to be transmitted. For very long "extra" h.p. lines the controlling factor is the kVA transmitted, and this controls the choice of voltage and size of conductor, but for very short lines the controlling factors are the voltage and the kVA capacity; very long lines, as well as very short and heavy power lines, should have ample synchronous condenser capacity at the receiver end, and perhaps at intermediate points of the line in the case of very long lines of the higher-voltage type. The design of the bigger lines divides itself into a determination of the most economical voltage, or a choice of a voltage about 12 per cent. below the critical disruptive value for the size of conductor chosen; the most economical kind and size of conductor; the most economical, safe and satisfactory spans; a calculation of the electrical characteristics for different loads, &c.; and, choice of ample synchronous condenser capacity for best performance, greatest kVA capacity, and most satisfactory operation.

Line designs are based on a given amount of energy to be transmitted, and the generating stations (when operated independently) must have ample capacity to supply the maximum annual peak, instead of the average daily demand; therefore interconnection of the generating stations would bring about something more than an economic necessity; the total ultimate kVA capacity could be obtained by a study of the probable ultimate daily load curves. The annual line loss should be proportional to the $(kW)^2$ transmitted; that is to say, the line loss at any time should be proportional to the square of the power transmitted The value of the kW-hour loss in the line defines its electrical characteristics, the conductor diameter and the line current being the criterion. In the design of a line it would be assumed that this line loss increases as the length of line increases; in other words, the line loss in per cent. would vary according to the transmission distance.

As the line voltage is increased for a given power, the cost of the line itself is reduced. There is, however, a size of conductor which is the minimum diameter because of corona loss and/or charging current, voltage regulation, &c., and these control the economic and practical limits for any given line, distance of transmission and load to be transmitted; on the other hand, for short lines the increase in line voltage is generally limited by the total cost of terminal apparatus and equipment. The increase in line voltage with increased length of line has little practical value, *i.e.*, for the big lines the 1,000-V per mile *rule* is almost worthless without a knowledge of the kVA to be transmitted. In the longer lines the voltage at the receiver end, on open circuit, will be higher than at the generating end, but in short lines the voltage will be higher at the generating end at all times; with the long line the capacity susceptance causes a leading current to flow through the armature of the generator, and as a result of this leading current the reaction strengthens the generator field flux and increases the voltage, which may be sufficient—on an unloaded line—to reach a dangerous value; therefore very little excitation is required and the magnetising action is offset by various means. Capacity susceptance and inductive reactance in the line are both proportional to the length of line, and in a small degree are dependent on the kind of metal and size of conductor used; when *steel* is used in the conductor, the resistance is a function of the frequency and current density. Line inductive reactance decreases slightly with increase in altitude, and the susceptance increases slightly with increases in altitude. For the same loss in the conductor, and for a line of maximum economy, the increase in the conductor diameter of aluminium is not in direct proportion to the comparative resistance of copper to aluminium, *i.e.*, the copper conductor might well be smaller than the aluminium equivalent conductor for the same kW line loss.

In the design of a power transmission line, the

*Elec. Rev., May 13th, 1927, p. 754.

engineer assumes a certain loss in transmission for maximum economy, determines the voltage and size of conductor, the line-support spacings and the height of the supports for permissible overhead and earth clearances, and so forth. The assumed kW line loss may suit the particular case, but the operating voltage may not be *standard* or the most economical, the conductors may not be of the material and kind to present the best or the most economical choice, the line supports may not be of the right type, &c., and their spacing may not give the safest or the most economical results, and, because of tower spacing or/and the conductor metal chosen, the insulators may not give the most satisfactory or the longest most economical service. In general, the larger the diameter of conductor, or the longer the spacing between line supports, or the more rigid the minimum overhead conductor clearance requirements, or the higher the mechanical stress in the conductor and wires, the less will be the number of standard (suspension) to anchor supports; this condition would be (or should be) increasingly intensified as the population becomes more dense. Whether lines be *rural* or main power transmission lines, there will result a great saving as well as decreased climatic and atmospheric hazards, longer life, &c., from taking every advantage of the minimum possible (or permissible) overhead clearance of the conductors, and it may be stated that for main power lines experience has proved that for voltages not exceeding 66,000 volts 20 ft. overhead clearance is indeed ample, and for *rural* secondary lines not exceeding 350 volts to earth 17 to 18 ft. overhead clearance at the lowest point of the conductor is quite ample for spaces of 60 to 100 yd. along roads in rural districts.

A change in tension of the conductor produces a change in the area of the conductor, but the mass remains the same. This mass is constant and is independent of the temperature, but the length of the conductor changes with the temperature, and, although this increase in length is partly offset by a decrease in tension, an increase in length will result from an increase in temperature whether it be ice-covered or not, and in consequence the sag of the conductor will increase; above a certain temperature (depending on the amount and direction of wind and other conditions) ice loading cannot exist. At a temperature ranging between + 22° F. and + 32° F. the sag will attain its maximum with ice and wind loads. Above + 32° F. ice cannot form on the conductor and supports, hence the sag is likely to be at its least value, but as the temperature increases above this value the sag will also increase. At a higher temperature (100° F. and above) maximum *vertical* sag will occur for all those sizes of conductors generally used in main power lines. An increase in length of the conductor between any two towers means an increase in the sag. For the smaller conductor diameters the maximum sag is likely to occur at a temperature of about + 30° F.; for the larger conductor diameters the maximum sag is more likely to occur at the maximum summer temperature. For all kinds of metal used as conductor, the tension of the conductor increases with increasing span length for all temperatures above 100° F., but the increase is slight for long spans—this is important. Also, for temperatures ranging between the stringing temperatures of 55° F. to 65° F. for the different sizes, the tension of the conductor is practically a constant value for all spans, the greatest variation in tension (with varying temperature) occurring in the short spans. For all temperatures there occurs very little variation in tension on the long spans—this also is important—on the other hand, we find that for any given kind and size of conductor the value of sag is practically uniform (with varying temperature and loading) for all spans. The most economical spans for the different stranded conductor metals range between 350 and 700 ft. for *aluminium*, 450 and 800 ft. for *copper*, and 600 and 1,100 ft. for *steel*.

Maximum stress acts on a conductor at the two points of its support when the temperature is a minimum and when, at the same time, the conductor carries its maximum load of ice and wind, &c. For equal stress, an increase in height of the line supports increases the weight of steel in proportion to the square of the height, and the area covered by the tower site also increases in the same proportion, *i.e.*, as the square of the height of the tower. The stress for which a steel tower is designed decides its weight and the length of its members. The cost of a tower foundation is but slightly affected by the height of the tower, the tension of the conductors is the criterion, and foundation cost is directly proportional to the tension of the conductors—this is very important, and favours the copper conductor.

Hydro-electric Expansion in Spain.

The Commercial Value of the Duero Scheme.

By PERCY F. MARTIN, F.R.G.S.

WHILE the Duero Water Power Convention recently concluded between Spain and Portugal is, first and foremost, of interest to those two countries, the compact entered into between the neighbouring administrations is not without interest to British and other foreign manufacturers of electrical machinery. Possessed though they may be—especially in the case of Spain—of a number of up-to-date and well-equipped workshops wherein many kinds of hydraulic electrical machinery can be constructed, in neither country are there establishments capable of dealing with the specially-designed plant that will be needed for the Duero undertaking. Until recently the hydro-electric manufacturing industry of Spain (and that of Portugal to an even greater extent) suffered from severe depression; the scarcity of ready money affected this class of engineering enterprise perhaps more than any other.

The Spanish Government over a period of years has found its resources restricted and unable to aid industrial enterprise by financial grants. Now that a substantial balance exists in the Treasury, a proportion of this surplus is to be devoted to hydro-electric development where it can best serve the interests of the community. Foreign financiers have hesitated to advance funds owing to their not-unnatural fear that the incidence of the Royal Decrees of June, 1921, would hinder them from obtaining remunerative concessions, and, when obtained, fetter their movements, especially with regard to the engagement of efficient and sufficient labour. Spanish capitalists, likewise, have been slow to take up new or experimental schemes. Hence the lack of large electrical factories in the country. The difficulties met with by the Sociedád de Fuerzas Electrícas, of Valencia, in which British firms are interested, may be cited as a case in point. Similar conditions have applied to Portugal, and both facts serve in a measure to explain the motive of the two Govern-

ments in coming forward to assist financially the development of the Duero scheme.

While Spain has imported during the past few years machinery, apparatus, etc., valued at between 300,000,000 and 400,000,000 pesetas per annum, its exports of such products have not exceeded a value of 6,000,000 or 7,00,000 pesetas; and even then but few of the manufactures have come under the head of electrical plant. Thus it will be necessary to place abroad considerable contracts for the Duero installation, and the fact should not escape the attention of British firms, some of which, at least, have already supplied machinery and plant to Spain for similar enterprises.

The Duero scheme will call for the installation of plant of an exceptionally important and novel type, demanding a display of great technical ability. Almost unanimous agreement has been arrived at regarding the design of the main installation and works. Some perplexing problems have, however, still to be solved.

In Portugal and Spain hydro-electric development is rendered difficult by the fact that all rivers alike, but especially the Duero, are torrential in winter and practically dry in the summer. This difficulty has been overcome to some extent by the building of dams across the river-beds and the creation of immense storage reservoirs. The irregularity of the flow of the Duero renders it necessary to construct exceptionally large storage works, the expenditure upon which would involve correspondingly high charges for electrical energy if the water could not be used also for irrigation purposes. For the latter utility, however, the Duero system of irrigation should prove extremely valuable owing to the long dry seasons which are experienced in its region. During the droughts, such as that experienced in parts of Spain this year, hydro-electric companies find that the level of water at the barrages falls to a disquieting extent, and, upon certain occasions, such, for instance, as in the month of May, 1923, less than four weeks' supply of water has remained in some of the reservoirs, entailing serious industrial difficulties. The Duero works are designed to furnish water for the cultivation of more than 1,250,000 acres of land in various provinces of Spain. The falls of the river on the Portuguese frontier are estimated to be capable of providing, however, only 300,000 h.p. out of the 6,800,000 h.p. which the whole of the Spanish rivers, combined, are expected to produce. Authorities, among them the distinguished Professor P. M. Gonzáles Quijano, estimate the basin of the Duero (Spanish) capable of contributing, as a maximum, 470,000 h.p., against 158,000 h.p. conceded.

During several years past there have been negotiations between the Spanish and Portuguese Governments regarding international utilisation of the waters of the Duero. Upon all occasions, however, negotiations have broken down. The most awkward question has been the site. It has now been agreed that the works shall be entirely on the Spanish side. While Spain will take 300,000 h.p. per annum, Portugal will be provided with 200,000 h.p. The river is expected to yield ultimately an international total of 800,000 h.p.

The Portuguese Government has always been favourably disposed, in principle, towards the project for utilising the waters of the Duero River, owing to the economy in imported coal that it was hoped would be effected; while the Executive Committee of the Municipal Chamber of Lisbon has been fully alive to the benefits attaching to an extra supply of electric power for that city. The Chamber has long been in possession of a proposal from a group of British bankers, working in conjunction with an eminent firm of English electrical engineers, for the carrying out of this project. On the other hand, the Electra del Lima, a Spanish undertaking belonging to a powerful group of electrical companies, had so far determined upon participating, either in conjunction with Portugal or under the auspices of the Spanish Government, in the Duero enterprise, as to issue 16,500,000 pesetas of capital, in 6 per cent. bonds, for the purpose of completing and extending the power and light works at Oporto, and furnishing an unfailing supply of water for irrigation purposes on the frontier of both countries. In order that the scheme might receive every consideration, the Spanish Government, in May last, fixed a time limit of six months for the resumption of negotiations with Portugal, and two years for the completion of an agreement for the harnessing of the Duero Falls in that part of the river forming the boundary between the two States. The Spanish Government felt so certain of the enterprise coming to a successful head that it granted concessions to the Sociedád Hispano-Portugésa de Transportes Electrícas and other interests for the production of electric power on various rivers, including part of the Duero. Had the Portuguese Government not agreed, it was resolved to proceed, in any case, with a smaller scheme for Spain.

The Rio Duero (in Portuguese *Douro*) rises in the Pico (Sierra) de Urbion, north of Soria, and south of the Sierra de la Demanda, in Spain. Its waters flow generally west across the Castillian tableland, passing south of Valladolid with Toro and Zamora on its right bank. At Sao Joao da Foz, below Oporto, they fall into the Atlantic Ocean. The river is navigable for small craft from its mouth for but 50 miles, but its total length is 485 miles, and the area of its basin is estimated at 37,500 sq. miles. The area drained includes the greater part of the vast plateau of Old Castile, between the watersheds of the Cantabrian mountains, on the north, and the Guadarrama, Gredos, Gata, and Estrella ranges on the south. The Duero forms the frontier between Spain and Portugal for a length of 65 miles and crosses the latter country through a narrow and tortuous bed, and a number of streams flow into it.

The contractors for the work of harnessing the Duero will have to deal with numerous rapids, or *pontos*, in the lower stream, the whole river being, in fact, subject to swift and violent inundations. Moreover, the mouth is partly blocked by a dangerous and extensive sand-bar.

The installation on the Duero River will not be the first enterprise of its kind undertaken. The Electra del Lima, a Spanish company, completed so far back as 1921 a hydro-electric station at Lindoso, on the Rio Lima, also a site situated near the Spanish-Portuguese frontier. This station comprises two groups of 10,000 h.p., the energy being carried at 75,000 volts a distance of 86 km. The energy is distributed by a Portuguese company known as Uniao Electrica Portugesa. Another important enterprise, of a somewhat similar character, is the hydro-electric company of Varoza, which has set up a h.p. line to carry the energy produced at its central power station situated on the Rio Vadega, one of the affluents of the Rio Duero, and produces some 7,500 h.p. The scheme, when completed, will provide a supply of 12,000 h.p. A third enterprise is that of the Companhia das Quedas d'Agua do Norte de Portugal. In this the Government has cooperated by financing the construction of a central power station at Villa Nova, where the Rivers Cavado and Rabagao converge. The station, which utilises the full power of these two rivers, produces 13,400 h.p., and it is hoped ultimately to extend its supply to 42,000 h.p. A financial syndicate, organised jointly by the Companhia do Credito Predial Portugese and by the Banco Nacional Ultramarino, are interested in a project to regulate the flow of the Paiva River, yet another of the Duero's many affluents, the total power obtainable being estimated at 20,000 h.p. Likewise, plans have been (or are being) drawn up for the utilisation of the waters of the Tavora, the Tamega, and the Coa Rivers, all being affluents of the mother-stream Duero. The Companhia Hidroelectrica da Sierra da Estrella has harnessed the energy derived from the higher waters of the Rio Alva and the waters from the Lago Comprida, two out of the four power

stations with a total capacity of 12,000 h.p., now supplying energy which is distributed mostly to textile mills within the important industrial zone of Serra da Estrella. During the winter months this station is in a position to supply energy to a large chemical industry works (calcium carbide) belonging to the Companhia Portugesa de Fornos Electricos. Other hydro-electric schemes include the utilisation of energy from the Alto Zezere and Vouga basin, a market which will comprise the important industrial centre of Coimbra, and extend as far as the coast.

So far as Government encouragement is concerned, hydro-electric development in Spain should shortly show an increase. One of the most important determined upon is that of the Sociedád Anónima Canalisación y Fuerza de Guadalquivír, between the towns of Seville and Córdoba, the works including a reservoir with a capacity of 400,000,000 cu. m. erected at Gandula, situated to the north-east of the city of Córdoba. The first station, which ought to be opened towards the end of this year, will be at Alcalá-del-Río. The Compañia Anónima Mengemor, the Sevillana de Electricidád and other important electricity supply companies have already undertaken to purchase the whole of the output, and as much more. The Government has granted a subvention of 50 per cent. of the estimated cost of this reservoir and promised to advance 40 per cent. of the total cost of the scheme, charging merely a nominal interest of 1½ per cent. per annum. When completed, the reservoir and power stations should produce 75,000 h.p.

There still seems to be some doubt as to the accuracy of estimates of the available water power. It is thought however, that potential power exceeds 6,000,000 h.p.; some have even placed it as high as 10,000,000 h.p. The one actual fact is that, during the past year, the production of the power stations established in the kingdom proved to be less than 1,500,000 h.p. This year, owing to the lack of sufficient rain and the resultant low water supplies, the power output may be even below these figures. Nevertheless, the chief supply companies, having installed a number of reserve thermic stations, will be able to meet the demand.

The A.C. Switchgear Buyer's Requirements.

The author calls for fuller details of the working conditions and general requirements of a.c. switchgear to be supplied to the manufacturers by the buyers when ordering or inviting tenders.

By B. NUTTALL, A.A.I.E.E.

SEVERAL articles have recently appeared in the Press discussing the merits and demerits of voluminous specifications for electrical equipment issued by both buyer and tenderer. The consensus of opinion appears to be that the buyer should so draw up his specification as to bring all competitors into line, giving the bidder the option of submitting an alternative design in the form of a separate and distinct tender. With the increasing number of standard B.E.S.A. Specifications, together with the recognised forms of contract conditions, such as those issued by the I.E.E., and the tendency, in this country at any rate, to use well-tried metal-enclosed, filled and air-insulated types of switchgear, specifications, even for the most complicated schemes, are showing signs of approaching that stage when the well-deserved nod on the part of the switchboard estimator will be a thing of the past.

The purpose of this article is to draw attention to the more important of those points which are sometimes overlooked by both parties. The majority of the "tickler" points are generally applicable to the various designs of switchgear. These will be considered first, followed by those which specifically apply to recognised designs. It is suggested that a consideration of this article before an inquiry is issued will save much time, labour, and expense for all parties interested. Naturally space limitations will not permit a discussion of the finer details and lesser important accessory equipment usually associated with switchgear.

The most common "crime" is the omission of the rupturing capacity of the breaker or the necessary details to enable a suitable breaker to be offered. The breaking capacity is all important and, generally speaking, it may be said that approximately the price of the equipment varies directly with the rupturing capacity. The two outstanding duties which a breaker has to perform are:—

(*a*) It must satisfactorily break the maximum short-circuit current under the most unfavourable conditions without undue signs of exhaustion for a predetermined number of times; and

(*b*) It must be capable of carrying normal or overload current without undue temperature rise. The former requirement usually determines the size and mechanical characteristics of the breaker, and in consequence the dimensions of the housing required. Frequently, in the case of power-station systems, the rupturing capacity also determines the current-carrying capacity of the breaker. If the rupturing capacity cannot be given, an idea as to the ultimate plant capacity of the system and whether it is or will be interconnected with others, should be furnished. If the station is or will be interconnected, the number, size, and length, or preferably the equivalent combined impedance (stated in ohms) of the interconnectors, together with the plant capacity of the system, expressed as full-load kVA in terms of the total "leakage" or "transient" reactance of the plant available on the respective station bus-bars, should be stated. If this information is not to hand, details of the machines should be given, when the remaining data required would be approximated.

Closely associated with breaker rupturing capacity is the disposition and rating of the external reactance installed in conjunction with the number of sets and the arrangement of the bus-bars. A single-line diagram embodying the essential information would save a great deal of trouble. Such a diagram would indicate at a glance whether single or duplicate bus-bars are installed, whether they are in plain ring (open or closed) or star formation, and also the disposition of the reactors. For bus-bar section or star reactors, the interchange of load, expressed either in amperes or kVA, should be stated, whilst with circuit reactors, such as are used for generator or feeder protection, it is necessary to know the reactive volt-drop expressed as a percentage of the phase voltage when passing the full-load kVA. Sometimes no reference to the available space is given, and not infrequently the switchgear undergoes a

"quart in a pint pot" transformation in order to accommodate in the space allowed. A little more thought on this point before an inquiry is sent would in the majority of cases enable a much better job to be effected.

It is now generally conceded that for the efficient protection of a.c. apparatus, the system should be earthed either directly or through a suitable resistance. Protective devices are so numerous and diverse that the following notes are given to assist those who are not very familiar with this branch of the work in forming an idea of those systems best suited to the particular scheme under consideration. Three-phase power transformers for pressures up to about 33 kV, and of capacities above approximately 700/1,000 kVA, should be protected by the self-balancing system or, alternatively, the Merz-Price system. In the latter case, especially for large-capacity or high-voltage transformation, each winding should be protected on a separate current-balancing system. It is recommended for generator transformer circuits that each apparatus should be separately protected. In the case of radial feeders, *i.e.*, feeders which do not receive an alternative supply at the remote end, overload protection with an inverse-time lag is suitable for the majority of cases. When the system is earthed, or when the electrostatic capacity of an insulated system is large enough, an instantaneous leakage trip can be advantageously included. For comparatively small systems with ring-main formation or with parallel feeders or interconnectors, and where short-circuit currents do not have an appreciable effect on the pilot wires, the Ferranti-Hawkins or McColl systems present an economic solution. For large blocks of power and where the lines are very long, satisfactory discrimination is secured by some form of discriminating *pilotless* leakage protection backed by definite time-limit overload relays. It may be mentioned that plain overload protection is often specified for ring-main feeders. This, of course, is always liable to cause a complete shut-down on the whole ring if there is a fault on any section of the feeders. It should be stated whether the system is earthed or insulated and, in the case of the former, when the gear has to line up with or be connected to existing apparatus, it will be necessary to know where the system is anchored and whether it is directly earthed or through a resistance. In the case of an earthing resistance being employed, full particulars of this apparatus should be given. It often happens that a neutral point is not available when a change-over is made from an insulated to an earthed system, and in this case the type and settings of the protective gear should be given careful consideration in order to ensure the installation of an earthing transformer of suitable capacity. It is also very desirable to know whether it is necessary to include for earthing connections, earth plates and testing equipment.

It is usually in connection with export inquiries received through factors that the vexed question of excitation arises. There are innumerable forms of excitation depending upon the type and speed of the prime mover. In addition to stating the capacity, voltage, and method of driving the exciter, information should also be included as to whether a stand-by source of excitation is provided, and whether regulation is carried out in the alternator field as well as in that of the exciter.

Switchgear manufacturers are sometimes expected to quote for complete power-station cable work without a layout being furnished or any suggestions respecting the probable lengths required. Unless a definite layout has been predetermined, it is suggested that cable work should be left until the switchroom layout and its location relative to the alternators, transformers, and so on has been decided upon. Although apparently an insignificant point to raise, the question of how the cables or connections approach the switchgear is really extremely important, and frequently makes a great difference in the design of the switchgear, particularly so in the sheet-steel cubicle, truck and cellular types.

It is modern practice to synchronise incoming circuit against incoming circuit, using a 110/110-volt single-phase reversing transformer if the synchronising lamps are to be at maximum brilliancy at the moment of synchronism. When extension equipment is required, it is absolutely essential, if the best and most economic scheme is to be offered, that the location of the existing potential transformers, the number of voltmeters, type of synchroscope, and method of synchronising be given in the inquiry.

The indication of the inclusion or not of automatic pressure regulators in the system would result in a saving of much work by *both* machine and switchgear manufacturers. Excellent questionnaires can be obtained from the leading machine manufacturers, with whom all preliminaries should be settled, and the final result should be embodied in the inquiry. The information should then include whether or not current or potential transformers, or both, are required, together with the regulator loading in voltamperes. With the primary object of economy, a trailing method of voltage control is sometimes employed, and if the handling of this equipment is left to the switchboard engineer, it is preferable that the method of control be indicated, as this saves alternative offers being put forward.

Control-battery apparatus frequently comes within the scope of the switchboard engineer, its primary object being to supply current to electrically operated oil-breakers, and, also, in the majority of cases, as a stand-by source for station lighting. Frequently data on this emergency lighting load is not given, yet it is expected that a suitable battery can be offered. The switchboard engineer can ascertain the size of the battery necessary for the oil breakers and signal lamps and quote for a suitable motor-generator set providing the a.c. voltage and frequency for the driving motor is stated. Another point which is not usually appreciated is that the switchboard engineer must communicate with both the storage-battery and motor-generator manufacturers; co-operation between all three is essential in order to submit the most economical proposition. It will be readily understood that this takes time, and a firm's tender, including this apparatus, cannot be sent by return mail as is sometimes expected.

When telegraph and telephone equipment is included in the inquiry, the most economical proposition can be offered if the number of orders and stations, together with the distance between them, is stated, and whether mechanical or electrical telegraphs are required. An outgoing circuit is sometimes simply stated as a feeder. This information is not sufficient; it is necessary to know whether it is a ring main feeder, an interconnector, a radial feeder, or a parallel feeder. The type of protection necessary varies considerably with the type of feeder. When extension equipment is required, it is necessary to know the pattern, type and finish of the existing instruments in order for the new equipment to match that existing as far as possible. Frequently equipment for motor circuits can be considerably cheapened if the load is approximately balanced, and it is always advisable to state whether instruments must be suitable for balanced or unbalanced loads.

In the case of remotely operated masonry-enclosed equipment, drawings of the existing cell and control board, with *essential* dimensions, will usually clear up the main points. The necessity for drawings will be clear on reference to the many varied arrangements of drives, apart from the actual variations in the equipment. It is interesting to note here that if the control board is more than, say, 15 ft. from the cell in a horizontal direction, or at right angles to the cell, then remote electrical control is recommended. If the manufacturer has a free hand, it is desirable to advise him whether the control board will overlook the engine room. In this case a desk-pattern board or a modification of it is necessary. Masonry-enclosed gear may be built entirely of brickwork, concrete, moulded stone, or a combination of these materials. When the cells are built of moulded stone, two distinct methods of construction are adopted. The first method consists of so moulding the

slabs that, with careful assembly on site, they form a solid and homogeneous self-supporting structure upon which fixing irons can be secured to the face of the vertical members to serve as supports for guards and screens. The alternative method, which is preferable for export trade, is to furnish a shop-fabricated skeleton iron structure upon which the supports for the gear, guards and screens are tried out in the factory, and for the buyer to purchase or make up simple slabs to the manufacturers' drawings and assemble them in the recesses provided by the structure which serves as a definite registration for the slabs.

Isolating features and interlocks are both points which are generally raised when quoting for extension gear of another manufacturer's production. They have a considerable influence upon the price of the equipment. They are correlated in so far that the extent of interlocking necessary on an equipment depends upon the type and design of isolator. For effective interlocking, gang-operated isolators are required, as this arrangement ultimately works out cheaper than interlocked hook-operated isolators. A desirable point is the inclusion of separate isolating features for potential transformers so as to enable the transformer to be examined without interrupting the main supply. Unless the potential transformer is arranged to be withdrawn on rollers and screened off from the fixed plugging members, the inclusion of isolating features usually adds considerably to the cost of the structure, as more often than not the arrangement does not lend itself to the inclusion of such a feature, when utilising pole-hook or gang-operated isolators.

For signal and indicating devices, it should be stated whether lamps are required both on the control board and cell, for the oil breaker only, or for the isolating switches as well. In connection with mimic circuits or auto indicating boards, there are several different arrangements, and if possible some indication as to the preferred design should be given.

Some reference should be made to the service conditions. Certain types of switchgear are unsuitable for use in concrete mills and factories where the atmosphere is heavily laden with dust, chemical fumes, and so on.

A point frequently overlooked is the ultimate busbar capacity. If the interchange of load between busbar sections or the total load on the busbar is definitely fixed, then the maximum section of the busbars can be figured out and an allowance made for future feeders, thus saving the cost of opening up metal-clad compound-filled chambers or carrying out alterations to existing busbars.

It is hoped that in a subsequent article the question of the submission of a tender on outdoor switchgear and the types of circuits to be controlled will be discussed.

It is felt that the above remarks may inspire engineers specialising in other branches of the industry to respond with similar articles so that a switchboard engineer may appreciate the difficulties of his brother engineers when the occasion arises for a composite tender to be submitted.

The International Electrotechnical Commission.

The Plenary Meeting at Bellagio, Italy.

(*Continued from page* 538.)

IN the paper which Mr. I. V. Robinson (B.E.A.M.A.) read before the Congress, on the "Unification of Terms, Definitions and Symbols," attention was drawn to several instances where small differences obtain in fundamental engineering units. He considers it impossible to conceive any change in the British foot-pound-second system, but advocates agreement in conversion factors.

The British "foot" is a defined proportion of the Imperial standard "yard," whilst the American definition refers to the proportion it bears to the metre. Both these standards are arbitrary, and the adoption of the wave-length of cadmium light is recommended.

The term horse-power is frequently used loosely, but should have an established basic value; one of its factors, however, is dependent upon the force of gravity, which varies in different latitudes and altitudes. In practice, it is known that the British horse-power is 746 watts, whilst the French cheval-vapeur is slightly less than 736 watts.

With regard to steam pressures, both gauge and absolute pressures are used in England and America, but the latter is mainly used on the Continent; alternatively the pressure is frequently spoken of as a certain number of atmospheres, the standard varying for latitude and needing exact agreement.

A communication from Mr. S. Norberg (Sweden) was entitled "Remarks concerning the Rating and Testing of Switches and Circuit-breakers."

Taking as an example a line pressure of 10,000 volts, Mr. Norberg advocates testing it to 40,000 volts, but applying a rather higher test-pressure to the insulator bushings of an oil circuit-breaker, as being a particularly important piece of apparatus; a flash-over at the oil switch is much more serious than a flash-over at an ordinary insulator support. Such switches may have to carry a heavy short-circuit current, and should be tested to withstand this, without mechanical deformation due to heat or other cause.

The main factors in determining the proportions of a main line circuit-breaker are the working pressure and current, but for a.c. systems, power factor must also be given consideration. It is generally agreed that a circuit-breaker must withstand the mechanical and thermal stresses of closing it on short circuit; the mechanical design is considered to be equally important as the electrical, and the operating mechanism should be tested by closing and opening the switch a certain number of times without load on.

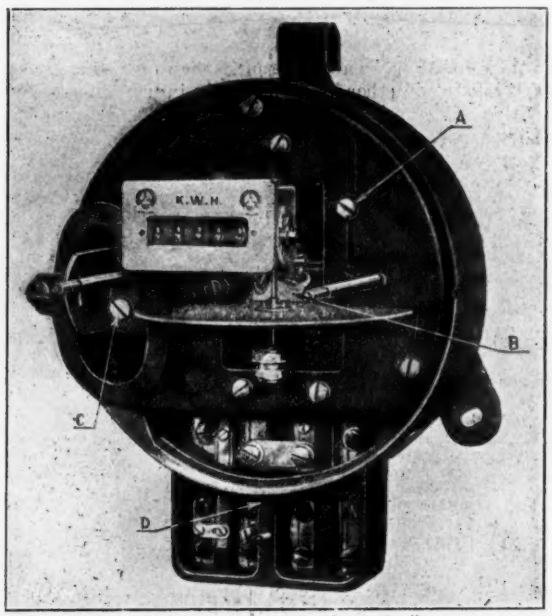
Mr. E. B. Wedmore (Great Britain) contributed a paper on the same subject, with special reference to "The Experimental Determination of Rupturing Capacity." He considers that it is impracticable to establish commercially the ratings of circuit-breakers until the knowledge of what is actually occurring in the circuit is further advanced. Oscillograph records show the extent of variations, but repeat tests bring to light degrees of lack of uniformity in the performance, which still need careful investigation.

Whilst the delegates were passing through Milan on September 13th, a considerable number of them took the opportunity to look at the works of the C.G.S. Measuring Instrument Co., Monza.

Motor-cars were provided to convey the party to the works, and they were received by the director, Eng. G. Bauchiero and the consultant engineer, G. Campos.

The works were established in 1896, and now employ about 1,500 hands, occupying 3½ acres. The company obtains orders for a large share of the electrical instruments required by the supply authorities in Italy, and exports to all parts of the world. Its a.c. meters are used in all the large towns, and appear to be substantially constructed, the 20-amp. size weighing about 4½ lb. The working parts are shown in fig. 1. The technical particulars are: shunt circuit loss one watt, series loss at full load 0.5 watt, the meter will start at 0.5 per cent. of full load, the guaranteed accuracy between one-tenth and full load is + or − 1.5 per cent., and this accuracy is not affected appreciably by normal variations of voltage, frequency or temperature. It is capable of working with 100 per cent. overload for long periods, and twenty to thirty times full-load current momentarily without injury.

The visitors were given the opportunity of seeing the whole process of manufacture, including the examination under a microscope of the jewels and their subsequent mounting; cutting off the steel bars, bending them



A=Induction-load adjustment. C=Full-load adjustment.
B=Low-load adjustment. D=Screw hole for fixing.

Fig. 1.—kWh Meter.

into shape, the magnetising process, and the pressing out of the cases.

The firm also manufactures several types of graph instruments for continuously recording the levels of rivers, canals and reservoirs (System Campos/Usigli), a wattmeter actuated on the Kelvin balance principle with both recorder and indicator, a frequency recorder, and another to record power factor at all hours.

Considerable space is devoted to the testing of all the apparatus, and a research laboratory is established wherein some of the models have been developed.

Whilst the masculine members of the Congress were visiting the works in Milan, just described, their lady companions were taken to see the Cathedral and one of the picture galleries. Subsequently, all met again at the central buildings of the Telephone Society of Lombardy and Piedmont to enjoy the sumptuous tea prepared for them, after which motor-cars took them back to the railway station. There the special train provided gratuitously by the Italian State Railway Department awaited them, and they proceeded to Venice and thence on by steamboat to the Lido.

This was a long day; heavy luggage had to be ready at 6.30 a.m.; the steamer left Bellagio at 7.30 a.m., and it was just on midnight when the Excelsior Hotel at the Lido was reached. The electric tramway service of the Lido was at the disposal of delegates during their sojourn there, and was much used from one end of the island to the other free of cost.

From Venice a most interesting excursion had been arranged to the important hydro-electric works situated along the Piave River—a district north-east of Venice, and well within the war zone, where the Italians finally expelled the Austrians and very materially hastened the end of the war.

Prior to the outbreak of the war, there were two stations working on this watershed of 9,000 and 6,000 kW respectively. Since the war, important changes have been made, and the works when finished will operate plant of 200,000 kW, with an annual output of 600,000,000 units.

The works belong to the Adriatic Electric Supply Co., which company also owns numerous other hydro and thermo electric stations. A dam to divert the water from the river has been constructed near Soverzene, at an altitude of 980 ft. above sea level; it is shown in the accompanying illustration, fig. 2. The wall of the dam is 1,310 ft. long, with capacity for a maximum flow in the canal of 2,500 cu. ft. per second. The average annual flow is about 780 cu. ft. per second.

The canal is partly constructed as tunnel through the rock and partly as an open cutting; it runs a distance of 5⅓ miles into Lake San Croce.

Extensive earthworks were seen at the Lake, where the

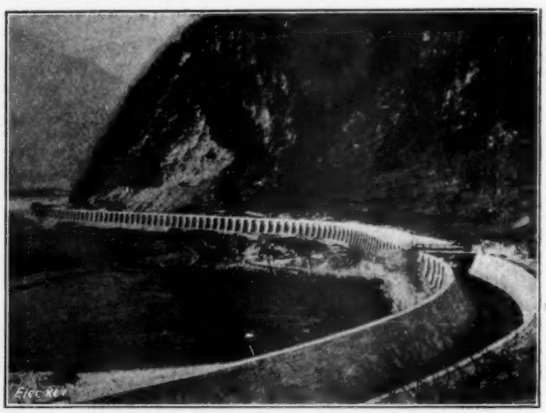


Fig. 2.—Canal Entrance from Piave River.

northern end is being enclosed by a retaining wall of increased height, whereby the total lake area will become half as large again as at present.

Consequent upon this alteration of water level, the main road along the edge of the Lake has to be diverted in places, and a new road is being constructed on the mountain side, necessitating considerable blasting operations, some of which were timed for the occasion of the visit.

The fall of water is employed at different stages. The first occurs at Fadalto, the second at Novi, a third and fourth of minor importance, and finally at the fifth works at Caneva. The total length of canal from the intake to the final discharge is approximately 13¾ miles.

The effective fall at Fadalto is given as 348 ft.,; five down-take pipes are in service, and three more will be used for the extension of the works; the walls and roof of the turbine house are in an advanced stage of construction. Generating machinery of 17,500 kW is already fixed, with an initial pressure of 6,600 volts, transformed up to 66,000 volts (it is intended later to increase this transmission voltage to 120,000 volts).

The energy produced by the various power houses on this water way is taken into the network of the Adriatic Company and distributed for various purposes. The State Railway Department is a large consumer; the network runs east to Trieste and south to Venice, Padua, and Ferrara.

The concession for the utilisation of the water power is fifty years; at the end of that period the Government recovers the water rights but not the machinery or transmission lines. It appears to be an equitable arrangement whereby the value and circumstances can be reviewed at the end of the period stated.

(To be continued.)

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Overhead-Line Costs.

With reference to the article on "Armoured Concrete Poles" by Theodore Rich, in your issue of September 23rd, a statement is made towards the end that roadside lines are being put up in France with concrete poles for 15,000 volts at about £100 to £130 per mile. This statement as it stands is manifestly impossible. Presumably these figures only apply to the cost of erection of the line, and do not include the cost of materials such as poles, line wire, and insulators.

J. A. Morton.

Prescot, *September 28th*, 1927.

House-wiring in Tropical Countries.

We have read with interest Mr. Palairet's letter in last week's issue on the subject of house wiring in tropical countries, and his suggestion that cable manufacturers in this country have not directed their researches to the production of cables suitable for the tropics prompts us to reply that we, as members of the Cable Makers' Association, have devoted considerable time and thought to this subject.

As originators of the tough-rubber-sheathed cable, usually known as cab-tyre sheathed, or C.T.S., we have been especially interested in producing a cable which will stand up to tropical conditions and, from reports and repeat orders which have reached us from actual users in the East during the past ten years, we are convinced that our efforts have not been without success.

From Addis Abbaba and Zanzibar to Malay and Uruguay, C.T.S. cables proclaim that manufacturers at home are alive to the special needs of our engineers abroad and are anxious to assist in solving their problems.

St. Helens Cable & Rubber Co., Ltd.

Slough, *September 28th*, 1927.

Capt. Dunsheath's British Association Paper.

Referring particularly to the curves, figs. 1 and 2, given by Capt. Dunsheath, relating respectively to "cost of system" plotted against "kilovolts" and to "total annual losses in units" plotted against "kilovolts," and taking the uppermost curve of the first-mentioned (namely, that for 100,000 kW), which terminates at a point corresponding with an outlay of £3 per kW, of which perhaps £1 10s. per kW would be allowed for step-up and step-down transformers, leaving, say, £1 10s. (to £1) per kW for the cable; this would work out at £0.15 (to £0.10) per kW *per mile*, for the cables only.

It would be interesting, however, to know the basis on which Captain Dunsheath has got together his prices for 132,000-volt cable, as there is none at present upon the market in Great Britain.

I have an impression that he has probably taken a figure which could be materially improved upon. The probability is that he has put forward a cable which is almost identical with the cable which has been recently tried in Newark, New Jersey, U.S.A.; where elaborate tests have been going on with three 132,000-volt cables, one made by the Standard Underground Cable Co., one by the Okonite-Callender Co., and one by the Safety Cable Co., the tests on which have been given in some detail in the *Electrical World* for 9/7/27.

I will therefore compare what could be done with a cable of this type, and what with an intersheath cable.

The depth of insulation on the Standard Underground, and the Safety Cable Company's cables, has apparently been worked out on the basis of not exceeding a potential gradient of 60 kV per cm., and this gives a depth of insulation of 30/32 inch, the figure actually adopted.

Incidentally, I wish to point out that, in my opinion, this large depth (24 mm.) for the impregnation of a paper cable is a mistake.

Among others, a serious objection is that, owing to the great depth of insulation, the heat cannot get away from the central core. From the data given in the *Electrical World* I work out that the thermal resistance per c.m. length is as high as 89.4.

(It would look, from the data given in the *Electrical World*, as though the cable is only guaranteed for 415 amperes; from which we may conjecture whether the British Engineering Research figure of 550 for (K) is as correct as the American figure of 750; or whether the duct system is the trouble.)

Comparing the above result with certain results worked out for the intersheath cable which I have had designed and tested, the thermal resistance between the outermost intersheath and the lead sheath of the cable is only 19.2 as against the 89.4 given above: *i.e.*, only *one-fifth* of that of the U.S.A. cable and *this is the only portion of the cable which is traversed by the heat units liberated in all the three cores.*

Without going into details I may say that for a much smaller cable, buried direct in the earth, I can utilise the present design of intersheath cable to transmit 138,000 kW (as compared with the 76,000 kW given by the United States makers) with an overall internal drop of 19 deg. C. made up as follows:—

Central core to first intersheath	6.3 deg. C.
First intersheath to second intersheath ...	5.9 deg. C.
Second intersheath to outer lead sheath ...	6.8 deg. C.

Now, the paper next to the second intersheath is obviously some 12 deg. cooler than that next to the central core, hence we might reasonably work it at 66 kV per cm., if compared with the New Jersey cable, where the temperature and power factor are so much higher, and the migration of the oil outwards is consequently more pronounced.

I submit, therefore, that if Capt. Dunsheath has worked on the ordinary lines in getting out his curve of costs he may quite likely be 45 per cent. to 80 per cent. too high, on the cable part.

Neither is it necessary to debit the cost of transformers in the case of cables used merely as an interlink with an overhead supply; but only where the cables are used *between stations* in a given city or town, and special transformation becomes necessary.

On the question of bending during laying, I construct the intersheaths of considerably heavier section than the innermost core, and they therefore stiffen the cable *very materially* throughout its section (working outwards); besides the very useful effect of pressing the papers closely together and *preventing discontinuity between paper* and *paper*.

It may be argued that we do not need to transmit such large powers per circuit, but it cannot be denied that we *do* need to have 100 per cent. spare capacity where there are only two circuits, and one is broken down. Hence the above 138,000 kW becomes a *normal* rating of only 69,000 kW.

A. M. Taylor,
Major S.O.2.

Birmingham, *September 30th*, 1927.

P.S.—The large increase in kilowatt capacity over a single-core cable is obtained under patents just granted me in the United States, Canada, Great Britain, and several other countries.—A.M.T.

A Proposed Mains Engineers' Association.

As one with many years' experience of cable manufacture, cable laying, and cable maintenance, I have often wondered at the non-existence of such an Association. This appeared to me to be so obviously necessary, that I felt sure it would be started sooner or later, but as nothing seems to have happened, I venture to ask the use of your columns to put the matter forward.

This Association would enable a body of men (whose endeavours to keep their circuits undisturbed at present depend almost entirely upon their own single-handed efforts and more or less limited experience) to help one another, by using the accumulated experience of all the members.

I venture to say that there is no one connected with electrical work whose needs of technical information can be less satisfied from books and papers, than the average mains man.

Such an Association would not only help the men themselves, but would be of value to their undertakings, in limiting the number of shut-downs to those that no amount of prevision will help, and in this way would be of value to the industry generally.

It may be suggested that the Institution of Electrical Engineers is the proper body to deal with this matter, and if the Institution would take the matter up in such a way as to be of use to the mains man, so much the better, but I have my doubts as to the possibility of this.

This matter has been discussed with several people who represent interested branches of the industry, and who now wait to hear the opinion of your readers, either in these columns or by writing to myself, before making arrangements to form a small committee to deal with the matter.

J. H. C. Brooking,
Managing Director, Greenwich Cable Works, Ltd.

Greenwich, *October 1st*, 1927.

A Two-Rate Meter.

I should like to say, with regard to Mr. Penning's letter in your issue of September 23rd, that the fact of there being two or three peaks during the 24 hours raises no difficulty with the two-rate system, but I certainly give him the point that a two-rate prepayment meter is not justifiable at the present time.

There is, however, a very considerable domestic load above the prepayment class to which the two-rate system would very well apply, and in which the time switch might at the same time take control of water heating during the night.

E. E. Sharp.

London, *September 30th*, 1927.

A New Radio Unit.

A praiseworthy attempt to combine current and length was made on September 25th by the Broadcasting Correspondent of the *Observer*, who wrote of "120 to 150 volts at 20 milli-ammetres from the mains."

Reviews.

Lectures on Dielectric Theory and Insulation. By J. B. Whitehead. Pp. vii+154; figs. 61. London: McGraw Hill Publishing Co., Ltd. Price, 12s. 6d.

In this book Professor Whitehead, of the Johns Hopkins University, has written an account of the lectures given by him when Exchange Professor to France in 1926-27. The ground covered is wide, and includes the normal properties of dielectrics, their anomalous properties, and certain aspects of the performance of high-voltage insulation. The general scheme is the correlation of theory with readily controlled experiments made on a laboratory or semi-technical scale, the details of both being mainly drawn from the literature of physics and of electrical engineering.

Lecture 1 is a straightforward account of the elementary theory of perfect non-conducting dielectrics, and calls for no special comment. Lecture 2 reviews the main experimental facts of the anomalous properties of the same class of bodies, and is a statement of the essential features of dielectric absorption and dielectric loss. One is particularly impressed by the simple and fundamental work done in the last quarter of the 19th century by Hopkinson and by J. Curie, and especially the manner in which they unravelled the law of superposition from the somewhat complicated phenomena of after effects of electric strain. Maxwell's theory of absorption is given fully in the third section; as is pointed out by Dr. Whitehead, its great merit is that it presupposes no other properties of a dielectric than specific inductive capacity and conductivity, and from these predicts the main qualitative features of absorption, with the one further hypothesis that most substances dealt with in practice are not homogeneous electrically. Maxwell himself recognised that his analysis was not completely adequate to explain all the experimental results, and the following two lectures are devoted to what are essentially attempts to improve upon his theory, either by introducing more definite ideas about molecular structure, or from anomalies of conductivity. The writer lays great stress on the totally differing natures of electric and magnetic hysteresis. The influence of water, which was studied so ingeniously by Evershed, is as interesting as it is of practical importance, and is illustrated with numerical data dealing with cable paper, cotton insulation and mica. Dr. Whitehead's plea for more carefully controlled experimental studies of Maxwell's theory will, we believe, be generally endorsed, and we would suggest that it would be well to remember that the recent work of Sir W. Bragg and others has shown that many substances previously believed to be amorphous are actually micro-crystalline aggregates and should show internal phenomena of the type of the piezo-electric effect: a systematic study of the electrical properties of Prof. H. B. Baker's intensively dried liquids might also decide once for all the exact rôle of water.

The remainder of the book is more definitely of practical value. Lectures 6, 7, and 8 are devoted to dielectric behaviour under alternating stress. It is unnecessary here to recapitulate the undesirable results of absorption in telegraphy and telephony, and in high-voltage transmission. Dr. Whitehead's conclusions can be best given in his own words (p. 116):—

"The alternating losses in solid dielectrics are due almost entirely to absorption. This is shown by theoretical analysis, and confirmed by experiment. The losses due to conductivity are usually very small, compared with those due to absorption, and there is no evidence of losses of other types. There is nothing to indicate a hysteresis loss of the character pertaining to magnetic materials."

The last lecture, on the properties of high-voltage insulation, is mainly experimental and contains particularly valuable information on the effects of moisture, dielectric absorption and gaseous ionisation in producing a dielectric phase difference. In addition to the index, there is a subject bibliography with over four hundred references.

The print is clear, and the diagrams—sixty-one in all—are well chosen and have adequate explanatory captions. There is a little repetition, which is almost inevitable in a report of a spoken course of lectures, but, on the whole, both author and publisher are to be congratulated on a valuable contribution to the literature of the subject.

Mercury Arc Rectifiers and Circuits. By D. C. Prince and F. B. Vodges. Pp. ix+233; figs. 155. London: McGraw-Hill Publishing Co., Ltd. Price 15s. net.

This book is divided into two distinct sections; the first, comprising 80 pages, is almost entirely descriptive, and is devoted to a general treatment of the principles and construction of static rectifying devices. The second section, which comprises nearly two-thirds of the book, is of a theoretical nature, and deals with the mathematical properties of rectified currents, and investigates the characteristics of rectifying apparatus.

The first two chapters of the first part deal briefly with thermionic rectifiers of the Kenotron and Tungar types, the remainder of this part being devoted to the mercury arc rectifier. After a general chapter dealing in a somewhat superficial fashion with machines of this class, a more useful treatment of the principles and characteristics follows, this being, however, of an entirely descriptive nature. The final chapter of the section contains a lengthy discussion of the question of "arc back," or "back starting," as it is otherwise termed. A considerable amount of experimental work has been carried out with a view to the elucidation of the cause of this phenomenon, and a good account of this work, and of the effect of wave form and frequency on the tendency to back starting is given.

The second part of the book commences with a mathematical discussion of the wave form of currents rectified by the several systems of transformer connection, and deals fully with the heating of the windings of transformers used in connection with rectifying plant. The remaining portion of the second part is devoted to a mathematical treatment of the question of the regulation of rectifiers due to external reactance, to inherent reactance of transformers, and to resistance, and the results obtained from theoretical reasoning are applied to the problem of the operation of battery-charging rectifiers.

The theoretical portions of this book will be of interest to the advanced student, and to the specialist in rectification problems. The descriptive matter is somewhat thin in character, and nothing is said of the operation of large steel cased rectifiers, or of their automatic control in unattended substations. We consider that the book would have made a wider appeal had the authors amplified the first portion, having in mind the requirements of practical engineers concerned with distribution problems.

Applied Magnetism. By T. F. Wall, D.Sc., A.M.Inst.C.E., A.M.I.E.E. Pp. vii+262; figs. 146. London: Ernest Benn, Ltd., 1927. Price, 28s. net.

Dr. Wall, in the preface to his book, points out the great strides which have been made in the development of the applied branches of the science of magnetism during the past few years. The large amount of research work in this field has been extraordinarily fruitful, and as the result of these researches materials are now available having magnetic properties which, fifteen years ago, would have been deemed hardly possible. The author cites the far-reaching effect of the discovery of alloys of the "Permalloy" class, in the design and construction of submarine cables, and Dr. Drysdale has recently drawn attention to the important bearing of the recent discoveries of new magnetic alloys on the design of electrical instruments. One of the most troublesome of the defects formerly incident to the use of permanent magnets in electrical instruments arose from the lack of permanence of calibration, due to the self-demagnetising tendency of these magnets, arising from an insufficient coercive force. This trouble could only be approximately overcome by the use of inordinately long magnets, rendering an economical design of the permanent-magnet class of instrument very difficult. The extraordinary increase in coercive force now obtainable in the series of cobalt magnet steels renders possible the use of higher flux densities, and obviates the necessity for inconveniently long magnets. The production of the high permeability alloys of the "Permalloy" class will render possible an enormous improvement in the characteristics of series transformers for power measurement in alternating-current circuits, and will thus very largely eliminate what was, till recently, one of the most serious and troublesome of the sources of error in measurements of this kind.

Dr. Wall has endeavoured in this book to give an account of the results of recent work in the field of applied magnetism, in a form intelligible to those of moderate mathematical attainments, and also to put forward in a brief form the present position of this science. After an introductory chapter dealing with basic theory, there is a very good account of the theory of permanent magnets, followed by a brief account of the physical and chemical properties of iron and iron-alloys. The magnetic properties of these alloys are next dealt with, and in this chapter the leading characteristics of the recently discovered alloys are given. There is an interesting discussion of the linear relation connecting reluctivity and magnetising force, a brief account of the effect of mechanical stress on magnetisation, and a good chapter on the electron theory of magnetism. Dr. Wall gives a full account of his recent work in the production of intense magnetic fields and of the examination of the behaviour of materials when subjected to such fields.

The second portion of the book is devoted to the subject of magnetic testing, and commences with a thorough treatment of the theory of the ballistic galvanometer and the fluxmeter. Various magnetic tests are then considered in detail, full practical details for the conduct of the same being given. Of special interest are the sections dealing with magnetic tests for flaws in wire ropes, and for the examination of rails, cutlery, and drills. These tests, as now perfected, form an admirable illustration of how a method of examination, at first seeming very unpromising, has, by the application of the methods of scientific research, been raised to a high degree of practical utility.

We have endeavoured to give a clear idea of the scope of Dr. Wall's admirable book. It should be definitely understood by intending purchasers that this scope is strictly limited to the subject indicated by the title, and that electromagnetic phenomena, and apparatus depending on them, are not touched upon. The book has evidently been written for engineers, and the general method of treatment is in every way suitable for such readers. Those desiring a thoroughly up-to-date work on the applied side of the science of magnetism, written by an acknowledged expert on the subject, will find in this book what they require.

Business and Industrial Notes.

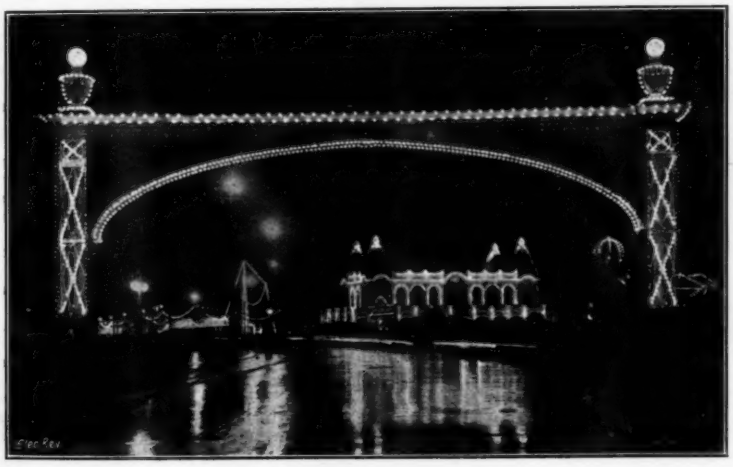
The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

A Countryside Battery Works.

It is not every works which has such beautiful surroundings as that of the D.P. Battery Co., Ltd. The company has issued a brochure containing many views of the country around Bakewell, Derbyshire, which proves that battery manufacture can be a rural industry. The D.P. Co. still employs a waterwheel which was erected in 1827.

Illuminations at Blackpool.

The special autumn illuminations arranged by the Blackpool authorities this year outshine all previous efforts. About 100,000 lamps have been employed in outlining the front and principal buildings with wonderful effect. Our illustration



Illuminations at Blackpool.

(reproduced by courtesy of the *Blackpool Gazette and Herald*) shows an illuminated arch and buildings, the effect being enhanced by the reflection from the wet road.

Exemptions from Indian Import Duty.

Under the Indian Tariff (Amendment) Act, 1927, certain classes of goods are exempted from payment of duty upon entering India, as from October 1st. According to the *Board of Trade Journal*, the exemptions cover prime movers, boilers, machines to be worked by electric power, control and transmission gear, copper wires and cables (bare or insulated), and poles, troughs, conduits, and insulators designed as parts of a transmission system.

New Zealand's Electrical Imports.

The *Board of Trade Journal* reports that the total value of electrical machinery and appliances imported by New Zealand in the June quarter of the current year was £641,455; this was by far the most important item in the import list. The suppliers were:—The United Kingdom, £369,721; United States, £131,662; Canada, £35,857; and Australia, £11,775.

Shanghai's Electrical Imports.

According to the United States Consul-General at Shanghai, the value of electrical machinery and fittings taken into that port during 1926 was £701,676, as compared with £541,140 in 1925.

Safeguarding British Exporters.

At a meeting of representatives of the trade and technical Press this week, Mr. A. M. Samuel, Parliamentary Secretary to the Department of Overseas Trade, explained in a very lucid manner the benefits and working of the Export Credits Guarantee Department of the D.O.T. He pointed out that before the Government introduced its scheme for insuring British traders against bad debts in export markets, nothing of the kind existed. While insurance companies were willing enough to cover fire, life, and marine risks, they would not consider export credit insurance. The Government's idea in instituting its scheme was to foster our export trade and to bring home to the companies the feasibility and necessity of this class of insurance. The Government had voted a fund of £26,000,000 (*i.e.*, had agreed to back a total risk of that amount), and the Department was advised by an expert committee. There were few formalities in the methods of applying the scheme. With the assistance of Chambers of Commerce, a simple form of floating contract had been drawn up. An applicant for insurance had to send his request through his bank, which gave a guarantee of the applicant's ability to fulfil his part of the contract. The standing of the foreign importer was quickly ascertained from the D.O.T. records or by inquiry by the local British commercial representative. When the contract had been approved, the bills covered by it received the Government stamp and were immediately negotiable at very reasonable rates. Indeed, it had been found that upon the return of the bills through the bank, the latter had decided to undertake the risk itself—that was what the Government aimed at: to stimulate the interest of private enterprise in the subject. The premiums charged for this service were very reasonable, and amounts so small as £5 were given the same degree of consideration as larger sums. The Department was limited to the guaranteeing of up to 75 per cent. of the amount involved. Very doubtful cases were, of course, not proceeded with, and in this direction the Department rendered useful service to traders, for such trade was not worth doing. In the event of default, the Department was in a far more favourable position than the private trader to recover the amount due. There should be no difficulty in dealing with the question of long-term credits now that this system existed. It was designed particularly to help the engineering industry, in which long-term credit was often essential. The scheme applied to goods which were wholly or partly of British manufacture, but the committee took a very broad view, and its sole desire was to foster British foreign trade.

M.E.M. Works Extensions.

The Midland Electric Manufacturing Co., Ltd., has recently considerably extended its works in Barford Street, Birmingham. The illustration shows the appearance of the works now that the new frontage is completed. The new

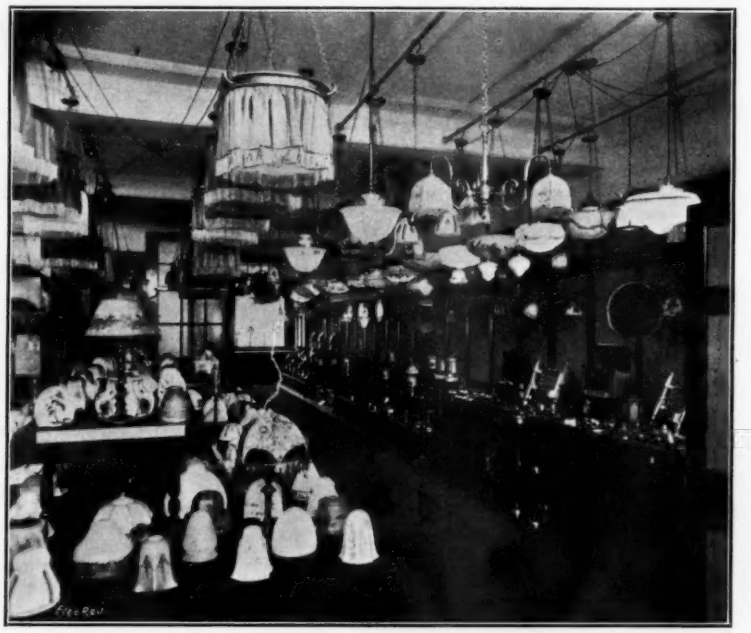
The Extended M.E.M. Works.

works is a self-contained organisation, built and equipped solely for the production of a limited range of ironclad switch- and fuse-gear. In addition to the usual engineering equipment, the works includes a complete iron foundry with the

latest hydraulic machinery, and a pottery works with the most modern plant for the production of a special grade of porcelain of high dielectric quality and of great mechanical strength. There is also a large plant for the production of high-grade insulation tubes and moulding.

New Welsbach Depôt at Leeds.

The depôt of the Welsbach Light Co., Ltd., Park Place, Leeds, was formally re-opened for business on September 26th. The depôt was burned out last October and has been rebuilt and greatly improved in the short space of eleven months. The new building has a rear goods entrance from York Place. It is in the centre of the city and is close to the three chief railway stations. There is a basement and five floors, with a spacious covered loading and unloading dock at the rear.



New Welsbach Depôt at Leeds.

At the entrance are offices through which the trade counter is reached. This is efficiently constructed for rapid service. Near it is a despatch department communicating with a loading dock at the rear of the premises. An ornamental staircase leads to the showroom, a panelled apartment tastefully furnished and decorated. This is depicted in the accompanying illustration, and, as will be seen, a good display of electric lighting fittings and other appliances has been arranged. The upper floors are used as stockrooms. The branch was opened by Mr. J. R. Yates, chairman of the company, supported by Mr. A. R. Barford (sales manager), Mr. R. H. Palmer (Palmer's Publicity Service), and a gathering of local people interested in the electrical and gas appliances business. The architects were Messrs. Chadwick, Watson and Co., and the principal contractors Messrs. Lazenby Bros., Leeds. The manager of the branch is Mr. F. B. Carver.

The A.E.G. in Russia.

The *Financial News* quotes some statements made by Herr Felix Deutsch, president of the A.E.G., in an interview with an American paper. The company named has during the past eight years done about £1,600,000 trade with Russia. He finds that negotiations with the Russians are laborious; they are inexperienced in business methods and fear home criticism, but they have so far been prompt and correct in their payments. The bulk of the above business has been the sale of electrical equipment, and credits for heavy installations are being given on a two or three years' basis. The A.E.G. is at present interested in the arrangement of a large credit or loan for the building of an underground railway in Moscow, and in financing power stations for other parts of Russia. Herr Deutsch further states that negotiations are in progress which will entail the transfer of French and American capital to Russia.

Dispute in the Contracting Industry Settled.

The strike of the employés of the Bective Electrical Co., Ltd., which had been in progress for about three weeks, involving 56 members of the Electrical Trades Union, was settled on September 29th. Apparently the man whose employment originated the dispute is to be retained in the company's service. The terms of settlement were as follows:—"If the E.T.U. agrees to withdraw any and every instruction to its members not to work for the Bective Electrical Company, and further, to withdraw its pickets, official or otherwise, the National Federated Electrical Association agrees, provided the above steps are taken immediately, and a sufficient number of E.T.U. men apply for work, to advise the Bective Company to dispense with the services of the non-union men engaged by them since the strike started, within seven days of the men applying for work, with the exception of the man and mate now working at Hereford, who shall be recommended to join the E.T.U. In the unlikely event of their refusing to do so within 21 days the matter shall be referred to the London Disputes Committee."

Export Orders.

Messrs. Crompton-Parkinson, Ltd., report considerable increase of export business during the month of August. Orders have been secured in India for the equipment of the Allahabad power station with two rotary convertors, 6-phase, reversible, each of 400 kW, also one of 200 kW, together with the necessary starting equipment. Large orders have also been received from New South Wales for turbo-alternators, and four oil engine-driven alternators. Five large auto-synchronous motors are also being supplied for pump drives for the Bunnerong power station, New South Wales. An order is now in hand for 19 125-h.p., 245-r.p.m., and 19 80-h.p., pipe-ventilated, slip-ring motors. Johannesburg has ordered three drip-proof auto-synchronous machines. Two drip-proof motors of 105 h.p., 415 V, 50 cycle, 3-phase, are being supplied for Southern Malayan Tin Dredging, Ltd. These are duplicates of others already supplied. An extension of the equipment of the Egyptian Sugar Refining Co. at Alexandria, consisting of three 175-kW, d.c. generators, is now in hand. Orders have also been received during the month for auto-synchronous motors for Singapore, Perth, Western Australia, New Zealand, and Vishnu.

Messrs. Hawkins at the Glasgow Exhibition.

In our last issue we published a brief note upon the Housing and Health Exhibition at Kelvin Hall, Glasgow. This showed that electricity had a very strong representation. One of the companies showing at the exhibition is L. G. Hawkins & Co., Ltd. A view of Messrs. Hawkins's stand accompanies this note. In this "Universal" cookers and other appliances are prominent, and there is a good selection of lighting fittings.

Messrs. Hawkins's Stand at Glasgow.

Trade Announcements.

The PREMIER ACCUMULATOR Co. (1921), LTD., announces that in future its sole agent for Scotland will be Mr. A. C. Borthwick, 149, St. Vincent Street, Glasgow, and all matters should be referred to him.

Messrs. STUART TURNER, LTD., Henley-on-Thames, makers of small electric lighting plants, have transferred their London office to Chandos House, Palmer Street, Victoria Street, S.W.1, where Mr. John W. Wilkinson, A.M.I.E.E., is in charge, and where the Stuart plants will be on show.

Messrs. W. R. SEFTON-FIDDIAN, LEAGE & Co. have dissolved partnership. Mr. W. R. Sefton-Fiddian is carrying on his business as agent for Messrs. Hudson & Wright, tube manufacturers, of Birmingham, at his present address, Bush Lane House, Bush Lane, E.C.4. Telephone No.: "City 2753." Mr. H. H. Leage will continue to act as sole London agent for Messrs. Long & Crawford, switchgear manufacturers, of Manchester, and for the Mersey Cable Works, Ltd. (as mentioned last week), at 33, Cannon Street, E.C.4.

MR. A. H. SEAGER is commencing business as a wireless and electrical engineer at Orient House, Station Road, Belmont, Sutton, Surrey.

Mr. G. A. HOPE, who has commenced business as an engineer and machinery merchant at 19, The Triangle, Yeovil, asks for catalogues of house lighting plants and electrical equipment and other electrical publicity literature.

Messrs. SADIA, LTD., have removed to larger premises, and opened a showroom, at 22, Newman Street, Oxford Street, W.1.

The MALDON ELECTRIC WORKS, LTD., has removed to 5, Great Winchester Street, E.C.2. Telephone: "Central 3231."

New Catalogues and Lists.

A.F.A. ACCUMULATORS, LTD., 120, Tottenham Court Road, W.1.—A series of illustrated and priced leaflets dealing with "Varta" high- and low-tension radio batteries and battery chargers.

VICTORY VALVES, LTD., Adswood, Stockport.—An illustrated folder giving details of the company's steam valves of various patterns.

BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.—Calendar cards for the last three months of the year, completing a handsome architectural series. Also a reprint from *Engineering* of an article on automatic starters for small power motors.

Messrs. H. E. ASHDOWN (BIRMINGHAM), LTD., Perry Barr, Birmingham.—A folder illustrating and describing the "Ashdown" shockproof lampholder for damp and acid-laden atmospheres.

Messrs. RICHSON & Co. (1925), LTD., 113, Oxford Street, W.1.—A comprehensive catalogue (70 pp.) of electric lighting fittings, mainly glassware. The book contains two or three hundred illustrations of bowls, electroliers, pendants, standards and other fittings, and is fully priced.

THE GENERAL ELECTRIC Co., LTD., Magnet House, Kingsway, W.C.2.—Four new illustrated and priced publications:—Section F.1, dealing with electric lighting fittings; F.2, electric lighting accessories; F.3, glassware for electric lighting; and a catalogue of "Gecophone" radio receivers and gramophone reproducers and accessories. The last is a most artistic production. The company has also issued an illustrated "broadside" in two sizes in connection with its "Gecoray" shop-window lighting campaign, together with an offer to shopkeepers of a free demonstration.

Messrs. EVERSHED & VIGNOLES, LTD., Acton Lane Works, Chiswick, W.4.—List 116 G, describing the re-designed "Dionic" water tester.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—An illustrated and priced folder containing particulars of the company's radio battery eliminators and charging devices. Also a window poster advertising a dual battery charger (h.t. and l.t.).

THE WENHAM LIGHTING CORPORATION, LTD., 184, Gray's Inn Road, W.C.1.—A leaflet advertising "Rex-Ray" shop-window reflectors and colour screens. Priced.

BRITTAIN'S ELECTRIC MOTOR Co. (formerly Langdon-Davies Electric Motor Co.), Eastdown Works, Dermody Road, Lewisham, S.E.13.—September price lists of single- and polyphase motors. Illustrated.

THE HART ACCUMULATOR Co., LTD., Stratford, E.15.—A mailing card suggesting a window display of the company's motor starting and lighting batteries.

Messrs. J. A. CRABTREE & Co., LTD., Walsall.—Leaflet No. 1023, advertising in an attractive way the "Crabtree" underslung switch movement.

THE BRITISH THOMSON-HOUSTON Co., LTD., Rugby.—A series of illustrated pamphlets dealing with fractional h.p. motors, push-button switches, d.c. slow-motion controllers, metal-clad switchgear, oil-immersed circuit breakers, &c.

POPE'S ELECTRIC LAMP Co., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—An October calendar-blotter and a priced pamphlet advertising "Elasta" lamps.

THE ARORA Co., Loughborough.—An abridged illustrated and priced catalogue of the company's electric fires and cooking appliances.

Messrs. L. ANDREW & Co., 2, Whitworth Street West, Deansgate, Manchester.—A leaflet advertising (with prices) "Wrendal" m.f. and "Capella" carbon-filament electric lamps.

THE GENERAL ACCESSORIES Co., LTD., 125, High Holborn, WC..1.—A folder describing the "Nettle" lampholder, which has a number of notable features.

CALLENDER'S CABLE & CONSTRUCTION Co., LTD., Hamilton House, Victoria Embankment, E.C.4.—An illustrated pamphlet dealing with the company's new single- and double-pole 10/15-A cut-outs and sealing chambers. Priced.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4.—Catalogue No. 169, containing numerous illustrations, details, and prices of wall brackets, hall lanterns, electroliers, pendants, and other lighting fittings. Also Catalogue No. Z.121, illustrating and describing "Siemens" ironclad switch- and fuse-gear. Priced.

HIGGS MOTORS, LTD., Witton, Birmingham.—A 42-page catalogue of industrial electric motors (a.c. and d.c.) with specifications, illustrations, and prices. Also an illustrated and priced list dealing with small battery-charging sets.

Messrs. FALK, STADELMANN & Co., LTD., 83-93, Farringdon Road, E.C.1.—An illustrated price list of "Efescoal" electric fires.

Bankruptcy Proceedings.

A. E. HUMPHREYS, electrical engineer, 20, St. James's Square, S.W.—The public examination of this debtor was held on September 27th, before Mr. Registrar Warmington at the London Bankruptcy Court. The receiving order was made on July 20th at the instance of a creditor, and accounts have been lodged showing total liabilities of £3,385 (unsecured £3,267), and net assets valued at £66, after deducting £87 for payment of the preferential claims. Replying to Mr. Wheeler, Assistant Official Receiver, the debtor stated that from 1912 to December, 1920, with the exception of the period from August, 1914, to January, 1919, during which he served in the army, he was apprenticed to a firm of electrical engineers; he was subsequently employed by a firm of electric lamp manufacturers until November, 1925. In that month he started business on his own account, being financed by a syndicate of five gentlemen, who each provided £50, on terms that any of them could withdraw his capital upon giving the necessary notice. One of the number withdrew from the syndicate and was repaid his £50 on January 1st, 1927. Witness was entitled to draw a salary of £6 a week, and to a share of the profits. The capital was required to carry out electrical contracts with various bodies. In March, 1927, he entered into a contract with the Ashton-under-Lyne Corporation to install electricity in 72 houses. At the date of the receiving order only about one quarter of the work had been completed, and his interest in the contract had been charged to the General Electric Co., Ltd., for the necessary supply of materials. Another contract pending at the date of his failure was with the House Builders' Association, Ltd., for electrical installations to 733 houses at the price of £3,660. That contract required about £860 to complete it. No profits had been made by the syndicate for the reason that very little business was transacted during the first six months, and subsequently a loss of about £900 was made by bad debts. In April, 1926, he realised that he was insolvent, but continued to trade because he had some important contracts in view. From October, 1926, to May, 1927, when the firm ceased to trade, he was partner with two others in E. Borman & Co., wholesale electrical factors. He provided no capital for that firm, but was entitled to two-fifths of the profits; the partnership was formed to supply him with materials for the contracts in his other business, because they, as factors, could purchase supplies cheaper than he could. He never received any profit from that firm, and on the other hand was liable to the extent of £233 for goods supplied to it. His liabilities included £417 on accommodation bills. He agreed with a certain company to supply him with electrical fittings, and gave them post-dated bills in payment for goods coming forward; he, however, could not obtain delivery of the goods, and cancelled the order, but in the meantime some of the bills had been discounted, and although he received a part of the proceeds, he found himself liable to the present holders of the bills. He admitted that his drawings for household and personal expenses had been extravagant. The examination was concluded. The following are creditors:—

	£		£
British Insulated Cables, Ltd.	149	Wandsworth Electrical Mfg. Co., Ltd. ...	28
J. H. Tucker & Co., Ltd.	29	Guildford Trust, Ltd. ...	417
Housebuilders' Association, Ltd.	24	Falk, Stadelmann & Co., Ltd.	42
Callender's Cable & Construction Co., Ltd. ...	137	Imperial Lighting Co., Ltd.	47
Baxter & Caunter, Ltd.	41	Wm. Geipel & Co., Ltd.	29
Electrical Conduits, Ltd.	133	Express Lift Co., Ltd....	27
Siemens & English Electric Lamp Co., Ltd. ...	458	C. E. Pridham	50
Siemens Bros. & Co., Ltd.	118	Daniel & Grover ...	60
General Electric Co., Ltd.	22	Comdr. H. Wallace ...	50
Sharpe & Fisher, Ltd. ...	25	W. A. Richards	50
Frigidaire, Ltd.	84	E. Windsor Bowen ...	50
Weiss, Behebber and Brooks, Ltd.	49	W. L. Butler	50
Young & Wildsmith ...	27	Housing Corporation of Great Britain	89
		Hampton & Sons ...	20
		E. Bowman & Co. ...	144
		Wm. White & Co. ...	343

CARL, otherwise CHARLES, SIEBER, 38, Brookside Road, Golder's Green.—A receiving order was made against this debtor on September 15th at the instance of a creditor. The

first meeting of creditors was held on September 28th before Mr. D. Williams, Official Receiver. According to the debtor's statements in preliminary examination, he came to this country in 1912 and became sales manager of an English company formed to exploit an electrical meter of German origin. When the war broke out, the company was wound up and the debtor was compelled to leave the country. In February of last year he returned, and shortly afterwards he tried to work the electrical meter business, but he failed in his efforts, and then became a manufacturers' agent. In March a limited company was formed, of which he became a director. In consequence of heavy expenses in connection with the Aliens' Restriction Act and of the failure of the meter business, and of the labour troubles last year, he ascertained in December that he carried a stock which he was unable to dispose of at a profit, with the result that he was forced to sell at the best prices obtainable. The debtor estimates his liabilities at £350, and values his assets, apart from shares in the company of which he is director, at £47. In the absence of any offer, the case was left with the Official Receiver to be wound up in bankruptcy.

Louis Samuel (lately trading as Smart's Stores), wireless accessories merchant, 54, Gracechurch Street, E.C.—The first meeting of creditors herein was held on September 28th before Mr. D. Williams, Official Receiver, when a statement of affairs was submitted showing liabilities of £1,134 and assets valued at £1,500. The chairman reported that in addition to the liabilities disclosed in the accounts, claims had been received from certain cash creditors. The debtor had stated in preliminary examination that in 1926 he purchased from a relative for £200 a wireless accessories business. This exhausted all his capital, but he obtained stock on a monthly credit basis. The rental of the shop was £8 a week. Six months later he had to give up possession of the shop, and took a lock-up shop at 54, Gracechurch Street, at a rental of £18 a week. The expenses consequently increased enormously, and he could only keep going by obtaining loans from friends. In December, 1926, he converted the business into Louis Samuel, Ltd., but the company was not a success and went into voluntary liquidation last February. The debtor attributed his failure to lack of working capital, bad trade and heavy overhead charges. Mr. W. Rowley, accountant, Newman Street, W., was elected trustee to wind up the estate in bankruptcy, with the assistance of a committee of inspection.

E. M. Lancaster, the younger, 21, Hanover Lane, Leeds, electrical engineer. The following are creditors:—

	£		£
Electric Lamp Fixtures, Ltd.	28	Lancaster, S.	225
		Lancaster, E. J. (Mrs.)	205

W. G. Conway (Listron), wireless component dealer, 88-90, Chancery Lane, W.C.—Application for discharge to be heard October 19th, at Carey Street, W.C.

A. P. Pacifico, J. P. Pacifico and R. Feitelson (Comton Wireless Co.), 26-28, Bartholomew Square, Old Street, E.C.1.—Last day for proofs for dividend October 11th. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

J. Wilson, electrical engineer, 70, Ebrington Street, Plymouth.—First and final dividend of 5s. 11½d. in the £, payable October 15th, at the Official Receiver's offices, 11, St. Aubyn Street, Devonport.

L. Mathias, electrical contractor, 469, Oldham Road, Failsworth, Lancaster.—Receiving order made September 24th, on debtor's own petition.

J. Spaven, electrical and mechanical engineer, 51 and 53, George Street, Bradford.—Last day for proofs for dividend, October 14th. Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford.

G. R. Sims, motor and electrical engineer, Hartlepool Street, Thornley, Durham.—First and final dividend of 8d. in the £, payable at the Official Receiver's offices, 14, John Street, Sunderland.

Dissolution of Partnership.

S. Peters & Co., electrical merchants, 111, Gt. Eastern Street, E.C.—Mr. P. Polishuke and Mr. S. Fishtenberg have dissolved partnership. Mr. Fishtenberg will attend to debts and continue the business.

Local Exhibitions.

Hipperholme.—The Electrical Distribution of Yorkshire, Ltd., has held an exhibition of electrical appliances for domestic uses at the Wesleyan School, Wakefield Road, from October 3rd to 8th, with electric cooking and washing demonstrations daily.

Aberdeen.—The Electricity Committee has agreed to hold another electrical exhibition in the city provided a statement of the estimated cost is submitted beforehand. The exhibition will be a joint undertaking by the Electricity Committee, electrical contractors, wholesale firms, and manufacturers in the city.

A "Brighter Homes" exhibition was opened at Aberdeen on September 30th under the auspices of Provincial Exhibitions (Scotland), Ltd. There is a good display of labour-saving appliances.

Dewsbury.—A Trades, Fashions, and Electricity Exhibition has been held this week in the Town Hall, under the auspices of the Dewsbury Chamber of Trade.

South-East England Electricity Scheme, 1927.

Copies of the above scheme prepared by the Electricity Commissioners and published by the Central Electricity Board can be obtained, price 2s. 4d., from H.M. Stationery Office. (See our advertisement pages to-day.)

An "All-Electric" Home.

An "All-electric" home, organised and arranged by Watson Marsh & Co., Ltd., was inaugurated on October 3rd at 346, High Road, Brondesbury, N.W., a luncheon being given by the company to representatives of the Willesden and Hampstead Councils, well-known electrical firms, the Press, &c. The luncheon was electrically cooked in the kitchen, equipped by the General Electric Co., Ltd., which is demonstrating its appliances during October. The British Thomson-Houston Co., Ltd., and the Hotpoint Electric Appliance Co., Ltd., will be responsible for the equipment and demonstrations during November, and in December Metro-Vick Supplies, Ltd., will take over the exhibition. Provisional arrangements have been made for Messrs. Falk, Stadelmann & Co., Ltd., to display their appliances during January, and other firms who have offered to assist during January, February, and March, 1928, are Messrs. Baxter & Caunter, Ltd., Belling and Co., Cable Accessories Co., Ltd., Edison Swan Electric Co., Ltd., Standard Telephones and Cables, Ltd., and the Sun Electrical Co., Ltd. Messrs. Watson Marsh & Co., Ltd., have instituted a hire-purchase scheme, and will accept inquiries for hire on behalf of the Hampstead Borough Council and the Willesden Urban District Council.

Verity Extensions.

Messrs. Veritys, Ltd., have recently completed an extension to their Plume and Victoria Works, Aston, Birmingham. Their accommodation for the manufacture and storage of lighting and heating goods has been more than doubled.

Book Notices.

"Aluminium Data" (18 pp.). London: The British Aluminium Co., Ltd.—This booklet contains a number of erection curves relating to steel-covered aluminium cables, illustrating the sag and tension at different span lengths of various sizes of cables.

"Thermodynamics Applied to Engineering," by A. F. Macconochie. Pp. xiv+260; figs. 65. London: Longmans, Green & Co., Ltd. Price 12s. 6d. net.

"Retail Selling," by Gladys Burlton, B.A. (Lond.). Pp. 192. London: Jonathan Cape. Price 5s. net.

"Post Office Electrical Engineers' *Journal*." Vol. XX. Part 3. October, 1927. London: Electrical Review, Ltd. Price 1s. 6d. net.

"Faraday House Journal." Vol. XII. No. 4; Michaelmas Term, 1927.—Every old Faradian will be interested in the armorial bearings of the College, which are reproduced and explained in this issue.

"The Essentials of Transformer Practice," by E. G. Reed. Second edition. Pp. xii+401; figs. 185. London: Chapman and Hall. Price 21s. net.

"Edison: The Man and His Work," by G. S. Bryan. Pp. viii+304. London: A. A. Knopf. Price 7s. 6d.

S.E. Lancs. Authorities' Change of Address.

This week the South-East Lancs. Electricity Advisory Board, the District Joint Board of Employers and Members of Staff, North-Western (No. 3) Area, and District Council (No. 3), North-Western Area, Electricity Supply Industry, moved to more commodious premises at Lawrence Buildings, 2, Mount Street, Albert Square, Manchester. The telephone number, "Central 1053," remains the same.

The Buenos Aires Subway Scheme.

We have already reported that the committee appointed by the Municipality of Buenos Aires has rejected the proposals of a syndicate headed by Lord Ampthill for the construction of underground railways in the city. The *Review of the River Plate* says that the committee's objections to the scheme were summarised as follows:—That the proponents failed to prove their financial capacity; that the guarantees offered were insufficient; that the scheme for exploiting the system considered in its economic aspects was not sound; that the construction and routes to be followed were disadvantageous from the points of view of hygiene, safety, convenience, and public economy; and that, even without taking into consideration the conclusions enumerated above, the project to construct and exploit the system on the basis of a complete exemption from all taxation was inacceptable.

New French Companies.

Among the companies recently formed in France are the Société d'Etude pour le Transport de l'Energie Electrique dans la Region du Sud-Est, organised in Paris (8, Rue Lammenau), with a capital of two million francs, and La Société le Crédit Electrique, Paris (39, Avenue de Friedland), capital six million francs. La Société Française pour l'Exploitation des Procédés Thomson-Houston and the Société Financière Electrique are interested in the Crédit Electrique concern, the object of which is to finance electrical undertakings.

Unemployment.

The total number of registered unemployed decreased by 4,550 during the week ended September 19th. The number at that date was 1,048,000, as compared with 1,052,550 on September 12th, and with 1,530,880 on September 20th, 1926 (coal dispute period).

Irish Free State Electrical Imports.

The Irish Free State Ministry of Industry and Commerce has issued detailed figures of imports for the first six months of the current year with a comparison for the corresponding period of 1926. From these we have compiled the appended table, showing the value of the total imports of electrical machinery and apparatus into the Free State and the amount attributed to the United Kingdom as country of shipment, but not necessarily of manufacture :—

	First Six Months.		U.K. Share.	
	1927.	1926.	1927.	1926.
	£	£	£	£
Electric wires and cables	57,687	50,472	21,989	28,380
Telegraph and telephone instruments and apparatus ...	21,081	22,575	17,785	18,644
Electric lamps and parts	19,136	24,636	15,652	21,920
Batteries and accumulators	12,548	16,194	12,036	14,517
Radio sets and parts...	35,307	58,662	34,279	56,284
Other electrical goods and apparatus ...	40,096	48,935	30,894	29,297
Generators	6,258	19,782	5,954	3,858
Motors	11,028	22,751	8,747	14,076
Other electrical machinery	43,373	40,459	38,160	30,238
Totals ...	£246,514	£304,466	£185,496	£217,214

It will be seen that with the exception of electric wires and cables and "other electrical machinery," there has so far this year been a marked decline in the importation of electrical goods and machinery into the Free State, the six months' total showing a falling off of £57,952, or about 19 per cent. Of the imports £185,496, or approximately 76 per cent., came from ports of the United Kingdom, leaving £61,018 for foreign countries. Of this balance £54,243 is credited to Germany, £3,110 to the United States, and £3,665 to "other countries."

New Italian Companies.

Among the concerns recently formed in connection with electricity generation and supply in Italy are: The Società Idroelettrica del Secchia, of Ferrara, capital 900,000 lire; La Società Impianto Idroelettrica di Confienza, Milan, capital 500,000 lire; and La Società Elettrica Sommese, of Somma, Lombardy, capital 50,000 lire.

Recent Contracts.

Recent contracts of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., include orders for eight electric winder equipments of the a.c. geared type. Six of the equipments are for use in this country, and two for collieries in India. Of the home installations three are for coal, one for an iron ore mine in Cumberland, and two are for tin mines in Cornwall. The British customers are the Horden Collieries, Ltd.; Messrs. William Baird & Co., Ltd.; the Coltness Iron Co.; the Hodbarrow Mining Co.; and the Anglo-Oriental and General Investment Trust, Ltd. The equipments for India are for the Jarandih Colliery of the Bombay, Baroda and Central India Railway and the Madras and Southern Mahratta Railway.

Among the installations of "Magnet" electric cooking apparatus which have recently been completed by the GENERAL ELECTRIC CO., LTD., is that at the students' hostel of St. Thomas's Hospital, London, the installation work having been carried out by Messrs. GAILLARD, ROBINSON & Co., Victoria Street, S.W.1, under the personal supervision of the chief engineer of the hospital, Mr. G. H. Franklin, M.I.Mech.E. The equipment, which was designed to cater for 300 persons, comprises a double-oven range which has fitted in the hob-table over the ovens six boiling plates (four enclosed pattern and two open coil type), as well as a substantial griller-toaster. For roasting meat and baking pastry there is a cabinet-type roasting oven, and for steaming puddings, vegetables, &c., a steaming oven is installed. There is a double-pan fish-frying set, and for quantities of vegetables a vegetable boiler fitted with various mesh containers to keep the different vegetables separate. By the serving lift is installed a large double-cased hot-cupboard with hotplate top. In the servery adjacent to the large dining hall there is a special hot-cupboard with carving wells and by its side a bain marie, and for the quick serving of toasted bread, &c., or a grilled chop or steak, there is a griller-toaster. In addition, there are another griller and a large double-lined urn for the personal use of late arrivals. The electric lighting of the hostel was carried out with G.E.C. fittings.

Belgian Radio Exhibition.

The Association of Belgian Dealers in Electrical Apparatus recently held a three-day exhibition of radio receiving sets and apparatus in the rooms of one of the large restaurants in Brussels, the last day being reserved for trade visitors.

Siemens-Schuckert Acquisitions.

The steam turbine and electrical department of the Demag Gesellschaft has recently been acquired by the Siemens-Schuckertwerke Gesellschaft, of Berlin, which has also taken over the old Thyssen Works of the Demag Co., at Mulheim.

Visit to B.T.-H. Works.

The Rugby Chamber of Commerce recently paid an official visit of inspection to the Rugby works of the British Thomson-Houston Co., Ltd. Mr. R. Dumas (works manager), in welcoming the visitors, stated that the pay roll of the British Thomson-Houston Co. provided something like half the purchasing capacity in Rugby. In Rugby, the B.T.-H. and the English Electric Co., Ltd., turned out about a third of the horse-power in steam turbines produced in this country.

Wages in the Contracting Industry.

The National Federated Electrical Association announces that in accordance with the national agreements regulating wages in the electrical contracting industry there will be a 2½ per cent. reduction in the basic rate of wages as from the second pay day in October. This represents an all-round reduction of ¼d. per hour, the new rates being as follows :—Grade A, 1s. 9¼d.; Grade B, 1s. 7¼d.; Grade C, 1s. 6d.; and Grade D, 1s. 4¼d.

New Australian Companies.

The following companies have recently been formed in Sydney :—Portable Wireless, Ltd., nominal capital £5,000; and the Prest-o-Lite Storage Battery Corporation (Australia), Ltd., capital £50,000.

European Industrialists' Conference.

A meeting of directors of industrial federations in Belgium, Czecho-Slovakia, France, Germany, Holland, Italy, Sweden and Switzerland, was held this week under the auspices of the F.B.I. A number of current European industrial matters were discussed, in particular, the resolutions of the World Economic Congress and the Stockholm Congress of the International Chamber of Commerce on such questions as Customs nomenclature, double taxation, import and export restrictions, &c.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances :—

	CHEMICALS, &c.	Price October 4th	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton.	£60	...
a	Ammonia, Muriate (large crystal) ,,	£82	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£95	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£18 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3¼d. to 3½d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3¼d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£107 to £112	...
b	,, Wire ... ... per lb.	1/6 to 2/-	...
b	,, Sheet ... ... ,,	1/3 to 2/9	...
p	Babbitts Metal and Anti-friction Metal—		
	Grade I ... ... per ton net.	£238	£13 dec.
	Grade II... ... ... ,, ,,	£165	£8 dec.
	Grade III ... ... ,, ,,	£86	£2 dec.
c	Brass (rolled metal 2" to 12" basis) per lb.	9¾d.	...
c	,, Tubes (solid drawn) ... ... ,,	11½d. to 11¾d.	...
c	,, Wire, basis ... ... ,,	9¾d.	...
c	Copper Tubes (solid drawn) ... ,,	1/0½	...
c	,, Bars (best selected) ... per ton.	£86	...
c	,, Sheet ... ... ,,	£86	...
c	,, Rod ... ... ,,	£86	...
d	,, (Electrolytic) Bars ... ,,	£61 17s. 6d.	12s. 6d. dec.
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£71 17s. 6d.	12s. 6d. dec.
d	,, ,, H.C. Wire per lb.	9/16 d.	1/16 d. dec.
f	Ebonite Rod ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	8/-	...
h	India rubber, Para fine ... ... ,,	1/2	½d. dec.
l	Iron Pig (Cleveland No. 3.) ... per ton.	75/-	...
l	,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g	Lead, English pig ... ... ,,	£21 15s.	30s. dec.
g	Mercury ... ... per bot.	£21 15s. to £22	...
e	Mica (in original cases) small ... per lb.	3d. to 8/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up.	...
p	Phosphor Bronze, plane castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/3	...
p	,, ,, rolled strip & sheet ,,	1/2½	...
p	,, ,, wire... ... ... ,,	1/3½	½d. dec.
o	Platinum ... ... per oz.	£14 10s.	...
d	Silicium Bronze Wire ... ... per lb.	10½d.	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
n	Tin, Block (English) ... ... per ton.	£268 5s. to £268 10s.	£9 5s. to £9 10s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	4/7	2d. dec.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

French Foreign Electrical Trade.

The French imports and exports of electrical machinery and apparatus during the six months ended with June last as compared with the corresponding half of 1926 are shown in the appended table :—

Imports.

	January to June. 1927. Tons.	Value. Francs.	1926. Tons.	Value. Francs.
Electrical insulators, porcelain goods, &c.	100	950,000	141	1,079,000
Electrical glass goods	0.6	16,000	0.2	9,000
Electric lamps ...	120.8	16,763,000	187	25,101,000
Dynamos	1,288	27,609,000	—	30,097,000
Wireless material ...	16.8	2,411,000	3.8	515,000
Wireless valves ...	9.2	2,491,000	0.7	54,000
Electrical apparatus...	584	36,830,000	544	37,594,000
Dynamo and motor frames	3.5	70,000	59.9	156,000
Electric wires and cables	502	9,379,000	128	5,298,000
Dynamo-electric armatures	175	9,411,000	309	13,442,000
Arc lamps and parts...	1	75,000	1	93,000
Electrical accumulators and parts ...	48.5	732,000	325.6	3,507,000
Dry batteries	7	96,000	6	140,000

Exports.

	1927. Tons.	Value. Francs.	1926. Tons.	Value. Francs.
Electrical insulators, porcelain goods, &c.	125.2	6,549,000	136.1	865,800
Electrical glass goods	430	1,454,000	600	6,540,000
Incandescent lamps ...	226	10,077,000	219	26,871,000
Dynamo-electric machines	3,625	41,835,000	3,024	3,490,000

Lighting and Power Notes.

Australia.—Victoria.—According to the *Electrical Engineer of Australia and New Zealand*, the quarterly statement of the Victoria Electricity Commission, covering the three months ended June 30th last, shows steadily increasing demand and revenue. The energy sold totalled 71,280,900 kWh, as compared with 45,301,470 kWh for the corresponding period last year, and the maximum demand on the system was 70,000 kW, as against 42,000 kW. The revenue amounted to £269,844 (£132,003), and the expenditure (including interest but not depreciation) was £248,776 (£177,855).

Bury (Lancs.).—Electricity Extensions.—An extension scheme, involving additions to the Chamber Hall generating station, to cost £99,000, is to be carried out by the Corporation. The Electricity Commissioners have sanctioned borrowing powers to cover the expenditure.

Canada.—Electrical Development.—A Power Commission recently appointed by the Government is at the present time engaged on investigating the power resources of the Saskatchewan Province, and it is expected to submit a report on a proposal put forward some time ago for the distribution of electricity among a number of rural communities. Apart from the feasibility of such a project, there is some disagreement as to whether power should be generated on the coal fields and distributed from there, or whether some power sites on rivers in the northern parts of the Province provide a better source of supply. According to the *Board of Trade Journal*, there is a growing tendency for municipalities to grant franchises to private corporations for the supply of power, and several companies are acquiring a number of these franchises. Four concerns, one with headquarters in the United States, one located in Winnipeg, and two in Calgary, are engaged in this business.

The Gatineau Power Company proposes to construct dams, power houses, &c., at the Magnan Falls, and is making application to the Provincial Government of Quebec for the necessary authorisation. The application specifies that the proposed construction will take place along the Oureau River, on or near the Magnan Falls.

Cardiff.—Year's Working.—The report of the borough electrical engineer (Mr. C. G. Morley New) on the working of the Corporation electricity undertaking for the year ended March 31st records a total income of £256,349, as compared with £242,721 in the preceding year. Working expenses increased from £117,870 to £135,792, as a result of the coal dispute, leaving a gross profit of £120,557, as against £124,851, to which was added revenue from other sources, making a total of £131,689. Capital charges absorbed £91,299, and there was a net surplus of £40.390, as compared with £50,176 in 1925-26. This was carried to appropriation account, together with a balance of £103,944 brought forward from the previous year, and distributed as follows: Works of a capital nature charged to revenue, £8,305; reserve, £23,941; borough fund, £112,087. The capital expenditure during the year amounted to £119,970, and included £42,171 for plant extensions, and £52,560 for mains and services. The sales of electrical energy increased from 32,500,954 to 33,519,696 kWh, and the maximum supply demanded from 15,636 to 15,803 kW. The average price obtained per kWh rose from 1.79d. to 1.83d. The length of cables laid amounted to 43 miles, bringing the total mileage of cables, exclusive of service cables, to 402.

Continental.—Germany.—The Rhenish Westphalian Electricity Supply Co. has recently commenced work on the establishment of a new transformer station at Remscheid. Hitherto, that town has been supplied with power from one of the company's 100/25-kV transformer stations. In view of the increasing demand, however, it has been decided to connect Remscheid direct with the Goldenberg power station by a 100-kV transmission line, and to install two 15,000-kVA transformers, one for 100/25 kV and one for 100/10 kV.

Work has recently been commenced by the A.E.G. of Berlin on the establishment of a 160,000-kW steam-operated power station on the lower Elbe at Schulau, near Altona. The initial plant to be installed will comprise three turbo-generators with a total capacity of 57,500 kW.

Switzerland.—The report for the second quarter of the current year respecting the power stations of the Federal Railways has been published. It appears from this report that the hydro-electric works of Amsteg and Ritom have produced 50.7 million kWh, of which 35.5 millions has been furnished by Amsteg, 13.2 millions by Ritom, and 1.8 millions by the Goeschenen station. Of this amount 50.1 million kWh has been used for electric traction. During the same period the Barberine-Vernayaz group of works has furnished 16.76 million kWh, Barberine contributing 6.33 millions and Vernayaz 10.42 millions. Barberine has transmitted 1.46 million kWh to the Swiss Central Distributing Station by means of the Vernayaz-Chièvres-Rupperswil transmission line. Of the electricity produced by this group, 16½ million kWh has been employed for electric traction.

Russia.—Work has recently been commenced, under the supervision of A.E.G. engineers, on the establishment of a new steam-operated power station to supply power for the iron-ore mines in the Krivoi Rog district of South Russia. The station is being designed to accommodate three turbo-generators, of which only two, each of 10,000-kW capacity, ordered from the A.E.G., of Berlin, will be at first installed. The boilers are to be adapted for pulverised fuel firing.

Croydon.—Loans Sanctioned.—The Corporation Electricity Committee has received sanction to the borrowing of £1,570 for mains, and £300 for sub-station equipment.

Dover.—Proposed Change-over.—The Corporation Electricity Committee has recommended that steps be taken for changing the frequency throughout the area of supply from 100 to 50 cycles, and the pressure, where necessary, from 100 to 200 V, at a total estimated cost of £20,153, and that application be made for sanction to a loan for this purpose. The first changes to be made will be in the Pier district, at a cost of £3,260.

Ferrybridge.—Works Inspection.—The Yorkshire Electric Power Co. is arranging for the first section of the new Ferrybridge power station to be open for inspection during this month. October 20th and 22nd are reserved for shareholders of the company, and invitations for October 18th, 19th and 21st have been issued to power users, local authorities, chambers of commerce, and other public bodies in the company's area.

Grangemouth.—Street Lighting.—The Town Council has accepted the offer of the Scottish Central Electric Power Co. to supply electricity for street lighting for the season 1927-28, at a cost of £179.

Grimsby.—Electricity in Bulk.—The Corporation Electricity Committee has arranged terms for a bulk supply of electricity to Louth Corporation.

Electricity Supply.—The Committee is to supply electricity to the Bradley district at a cost of £3,420.

Guildford.—Electricity in Bulk.—At a recent meeting of the Corporation Electricity Committee, the consulting engineer and the borough electrical engineer reported that, in order that negotiations for bulk supplies of electricity might be proceeded with, it was necessary that the general terms and conditions for such bulk supplies should be drawn up. The undertakings to which such supplies could be conveniently given, with an indication of their approximate requirements, were :—Aldershot, 750 kW; Farnham, 450 kW; Dorking, 400 kW; Cranleigh, 160 kW; Godalming, 400 kW; and Woking, 3,000 kW. Preliminary negotiations had taken place with Aldershot, Farnham, Cranleigh and Woking undertakings, and they had agreed upon draft conditions. The engineers were empowered to open up negotiations with the undertakings on the lines they suggested.

Change-over.—The Committee has obtained an Order authorising the following alteration in the system and pressure of the supply :—In the parish of Shalford, from d.c. at 220 V and 440 V and single-phase a.c., 50 cycles, 220 V, to 3-phase a.c., 50 cycles, 230 V and 440 V.

Loans Sanctioned.—The Committee has received sanction to loans of £7,500 for mains and services, and £2,500 for meters.

Hawarden.—Electricity Supply.—The Rural District Council Electricity Committee is applying for sanction to the extension schemes referring to Ewloe, Aston and Sealand. Sanction has been received to the borrowing of £17,500 for underground mains, services, plant, and meters, and £1,000 for an assisted wiring scheme.

Irvine (Ayrshire).—Street Lighting.—The Town Council is to arrange with the Ayrshire Electricity Board for lighting lamps, including an extension of lighting, at an annual charge of £943. The offer by the Board for providing and wiring new lamps, &c., at a cost of £500, has been accepted.

Keighley.—New Plant.—At a meeting of the Town Council on September 27th, reference was made to a scheme proposed by the borough electrical engineer (Mr. H. Webber) for the installation of boiler plant and one 2,000-kW steam turbine. The estimated outlay is expected to be between £40,000 and £50,000. The matter is being considered by the Electricity Committee.

Lowestoft.—Loans Sanctioned.—The Corporation Electricity Committee has obtained sanction to loans of £8,000 for mains and services, and £2,000 for meters.

Lytham-St. Annes.—Loans.—The Town Council is applying for sanction to borrow £7,943 for cables and sub-station equipment, and £7,000 for electrical apparatus to be let out on hire.

New Zealand.—Auckland.—The Public Works Department has decided to install auxiliary plant to cope with the shortage of power which is anticipated in Auckland in the near future owing to delay in the hydro-electric works at Arapuni. According to the *Electrical Engineer of Australia and New Zealand*, an order has been sent to England for three 1,600-h.p. Diesel engines which were built in Germany in 1918 and taken over by the British Government in part payment of reparations. Each will drive a 1,250-kW alternator, and orders for these alternators have been placed with the English Electric Co. The new plant will probably be installed in the Government sub-station at Penrose.

Christchurch.—The report on the working of the City Council's electricity undertaking for the year ended March 31st last shows a total income of £182,180, as compared with £165,708 in the preceding year. Practically the whole of the supply is purchased in bulk from the Lake Coleridge power station of the Public Works Department, and the cost of this, together with working expenses, amounted to £105,334, as against £85,995, leaving a gross profit of £76,846 (£79,703). After meeting capital charges there was a net surplus of £23,997, as compared with £30,953 in the previous year. The electrical energy sold increased from 25,588,802 to 29,119,422 kWh, and the maximum supply demanded from 7,760 to 8,078 kW. The average price obtained per kWh fell from 1.563d. to 1.497d. Five new sub-stations were constructed during the year, two of 300-kVA and three of 600-kVA capacity.

Padiham.—Loans.—The Urban District Council is to apply for sanction to loans of £1,500 for mains and services, and £500 for meters.

Plymouth.—Electricity Supply.—At a recent meeting of the Corporation Electricity Committee the electrical engineer was instructed to submit a plan for lighting Tavistock Road, Devonport, from the Milehouse tramway depôt to the borough boundary at the end of Tor Lane. Cable extensions were authorised in seven streets in Devonport, St. Budeaux, and Plymouth.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Llandudno.—Lighting: From 5d. to 4d. per kWh.

High Wycombe.—*Wycombe (Borough) Electric Light and Power Co., Ltd.*—Lighting: From 9d. per kWh for the first 100 kWh per quarter and 8d. beyond, to an all-round charge of 8d. per kWh.

Hebden Bridge.—Charges for electricity reduced by ½d. per kWh.

Cardiff.—Lighting: Flat rate, from 4½d. to 4d. per kWh, with a corresponding reduction in the case of street and shop lighting, and supplies given under special contracts. Power (flat rate), heating, and cooking: A reduction of ½d. per kWh.

Renfrew.—Street Lighting.—The question of lighting the car routes with electricity instead of gas was recently considered by the Watching and Lighting Committee, when it was stated the lowest offer was £1,800. The Committee decided to have a comparative statement prepared showing the relative costs of lighting by electricity and gas.

Seaham Harbour.—Street Lighting.—The Urban District Council has obtained sanction to a loan of £2,000 for the provision of fittings for street lighting in connection with the electricity undertaking.

Shipley.—Electricity in Small Houses.—The Urban District Council Housing Committee has had under consideration schemes for the installation of electricity in working-class houses, and has approved a scheme under which the cost of installation, including meter and service charges, is to be recovered by an additional charge per kWh. The scheme is to be limited to houses not exceeding £10 rateable value and where mains are available, the additional charge is to be 3d. per kWh, which, it is estimated, will effect repayment in ten years.

Loan.—The Council is applying for sanction to borrow £3,600 for the purchase of domestic electrical apparatus to be let out on hire.

Thirsk.—Station Inspection.—The power station of the Northern Counties Electricity Supply Company was recently opened to the public for inspection, special attention being drawn to various improvements installed during the past four years under the direction of Mr. H. D. Phelps, the resident engineer, especially to meet growing needs for domestic power, heating, and cooking. The station has in that period been practically reconstructed and the old machinery replaced. There was also an exhibition of electric cookers, wash-boilers, radiators, &c., for household uses.

Warrington.—Loans.—The Corporation Electricity Committee is applying for sanction to a loan of £20,000 for mains and services. Sanction has been received to a loan of £2,350 for extending mains to the Agden Salt Works, Lymm.

Willesden.—Year's Working.—The accounts of the Urban District Council's electricity undertaking (engineer: Mr. A. W. Blake) for the year ended March 31st last show a total income of £177,185, as compared with £152,045 in the preceding year. Working expenses amounted to £136,302, as against £107,835, leaving a gross profit of £40,883 (£44,209), to which was added revenue from other sources, making a total of £42,751. Capital charges and special expenditure charged to revenue totalled £44,923, and there was a net loss of £2,172, as compared with a surplus of £1,551 in the previous year. The capital expenditure during the year amounted to £30,570, the chief item being £18,278 for mains and services. The electrical energy purchased from the North Metropolitan Electric Power Supply Co. increased from 20,282,490 to 22,016,950 kWh, and the sales from 17,328,529 to 19,234,655 kWh. The average price obtained per kWh increased from 2.060d. to 2.122d. The revenue from the electrical showrooms amounted to £3,774, and after deducting all charges there was a net surplus of £253.

Wimbledon.—Loan Sanctioned.—The Corporation Electricity Committee has received sanction to the borrowing of £12,500 for the purchase of domestic apparatus.

Tramway and Railway Notes.

Australia.—Tramway Development.—According to *Commerce Reports* the route mileage of tramways in the Commonwealth at the end of 1926 totalled 633, made up as follows: Electric tramways, 519 miles; steam tramways, 75 miles; cable, 39 miles; and horse, 1 mile. Over the period 1918-1926 the number of car-miles run per annum increased from 41,454,000 to 65,303,000, and the number of passengers carried rose from 431,390,000 to 647,351,000. The gross revenue increased from £3,405,123 to £6,633,563, and the working expenses from £2,516,117 to £5,510,118. In order to cover the increased costs, fares have been raised, but still the revenue has not kept pace with the expenditure. In 1918 the percentage of working expenses to gross revenue was 73.89, but in 1926 it was 83.06. The greatest fall in revenue caused by 'bus competition occurred in 1923, but revenue increased in 1926, probably owing to the fact that several cities began to regulate the competing 'bus services.

Sydney.—The *Industrial Australian and Mining Standard* states that the electrification of the Sydney suburban railway system has been extended to the north shore of the harbour. It is expected that the system will shortly be working regularly. The electricity for the line is conveyed in cables laid in a deep tunnel under Sydney Harbour from Longnose Point to Greenwich. The driving of this tunnel was started about six years ago, and finished during the past few months.

Blackpool.—Year's Working.—The accounts of the Corporation tramway undertaking (manager, Mr. C. Furness) for the year ended March 31st last, record a total income of £279,985, as compared with £297,942 in the preceding year. The coal dispute resulted in the abandonment of the jubilee celebrations and autumn illumination schemes, and this was responsible for the decrease in revenue. Working expenses, &c., increased from £197,146 to £200,177, and there was a gross profit of £79,808, as against £100,796, to which was added a gross profit of £6,486 from the motor-omnibus service, and revenue from other sources, making a total of £88,192 available. After providing for capital charges, there was a net surplus of £47,237, as compared with £64,499 in 1925-26. A contribution of £17,000 was made to the borough fund. The capital expenditure during the year amounted to £114,950, the chief items being £67,239 for permanent way, £12,551 for cars, and £16,833 for omnibuses. The number of passengers carried decreased from 44,731,094 to 41,880,646, and the car miles run from 2,935,852 to 2,880,138. The receipts per car mile fell from 24.34d. to 23.33d.

Continental. — Alsace Lorraine. — Authority has been granted for the electrification of the tramway system in the Mulhouse district.

Belgium.—Plans are being prepared by the Société Nationale des Chemins de Fer Vicinaux, of Brussels, for the construction of a single track light electric railway between Zeebrugge and Bruges.

London.—Tramway Improvement.—The *Tramway and Railway World* reports that, as a remedy for the traffic congestion at Finsbury Park, plans have been approved for bringing tramcars to the pavement edge outside Finsbury Park station during rush hours. An extra track is to be laid alongside the kerb at the junction of Seven Sisters Road and Stroud Green Road to enable passengers to enter the cars at the footpath. To allow of this, a slight setting back of the pavement will be necessary, and the new siding will be long enough to allow four cars to load simultaneously. The scheme now put forward is not expected to cost more than £2,600 and passengers leaving Finsbury Park station will be able to board the tramcars without stepping into the roadway. The L.C.C. tramcars have to load at the rate of 3,000 passengers per hour during the busy periods and it has been found impossible, owing to the large number of services from this point, to institute a queue system.

Redruth.—Abandonment of Tramway.—The tramway between Redruth and Camborne, owned by the Camborne and Redruth Co., was abandoned on September 30th. A ten-minute motor-omnibus service was instituted by the Cornwall Motor Transport Co., Ltd., on October 1st.

York.—Transport Developments.—The Tramways Committee has recommended the City Council to apply for powers to operate railless-car services on any or all of the existing tramway routes, and to operate petrol 'buses on any road (subject to the Ministry of Transport sanction) within ten miles of the city boundary.

Telegraph and Telephone Notes.

Australia.—"Beam" Radio-Telegraphy.—Mr. Bruce, the Prime Minister, states that during the past two months only 2 per cent. of the messages handed in for transmission by the "beam" radio-telegraph service has been transferred to the cable companies. The amount paid for the transmission of these messages was £3,293.—*Reuter* (Sydney).

China.—Radio Communication.—According to Harbin reports, the Chinese Eastern Railway Co. has decided to install radio receiving sets in the residences of the more important staff members and directors, as well as in the offices of the railway administration. Altogether 35 sets of the 6-valve type have been ordered, says the *Chinese Economic Bulletin*, and the installation will be gradually extended to other quarters in the near future.

The Telegraph Service.—Staff Reduction.—The Union of Post Office Worers has received a letter from the Postmaster-General with reference to the decline in telgraph traffic. The number of inland telegrams was 78,269,000 in 1912, and in 1920 it was 82,500,000. Since then the number has decreased yearly, and in 1926 it was 49,783,000. The Postmaster-General regrets that decreases in telegraph staff, both on the rank and file and on the supervising staff, are likely to be necessary. It will be recalled that recently a committee was set up by the Postmaster-General to examine the possibility of effecting substantial economies in the working by the State of the inland telegraph service. The Union of Post Office Workers is preparing a reply to the Postmaster-General.

The Telephone Service.—New Norway Circuit.—The British Postmaster-General announces that a telephone service was inaugurated on October 1st between this country and Norway. Communication will be restricted at the outset to calls between subscribers in the London telephone area and subscribers is Oslo.

Talk with Switzerland.—An experiment of interest was carried out recently when the Post Office asked *Reuter's* Agency to take a test telephone call. Communication was then established with Maloia (Engadine), and a conversation was carried on for three or four minutes. The speaker in Switzerland was heard well, while he stated that he could hear Reuter's representative as clearly as if the latter were speaking from Zurich.

Transatlantic Telephony.—Canadian Service.—On October 3rd a new telephone service between this country and Canada was inaugurated. The service will be available daily and will, for the present, be restricted to calls between subscribers in the London telephone area and subscribers in Ottawa, Quebec, Montreal, Toronto, and Hamilton (Ontario).

United States.—Mexican Telephone Service.—Telephone communication between the United States and Mexico was opened for public use on September 29th with a conversation between President Coolidge, at Washington, and President Calles, at Mexico City. Official greetings were exchanged. By this latest development, for which the Bell Telephone Co. and the International Telephone and Telegraph Corporation of Mexico were responsible, it is now possible, says *The Times*, for Americans to talk to most of the principal Mexican cities, including, in addition to the capital, Puebla, Tampico, Victoria, Saltillo, and San Luis Potosi. The total length of the circuit between New York and Mexico City is 3,134 miles.

Radio Notes.

Australia.—New Stations.—The plans for New South Wales State broadcasting service have been extended and will probably cost £30,000 instead of the original £23,000. In addition to the Sydney broadcasting station and half-a-dozen relay stations, there will probably be thirty subsidiary stations of low power.

Interference.—Following complaints from listeners in Victorian country districts that the reception of the programmes broadcast during several days by 3LO (Melbourne) had been practically useless owing to interference from another station, inquiries revealed the fact that JOAK (Japan) was the cause, it having practically the same wave-length as 3LO. Cables were sent to Japan in an endeavour to remedy the trouble, and arrangements have been made for 3LO's wave-length to be reduced by several metres.—*Reuter's Trade Service* (Sydney).

Empire Broadcasting.—B.B.C. Announcement.—In pursuance of the policy of developing a practical basis for effective Empire broadcasting as rapidly as possible, an experimental short-wave transmitter is being erected at the Marconi works at Chelmsford, which will make use of the two 480-ft. masts situated there and carry out experiments, working chiefly on a wave-length of 24 metres; arrangements have been made for the collection and analysis of reports of these experiments in various parts of the world. The station, whose call sign is 5SW, will use power up to about 25 kW, and should its performance be unexpectedly successful in the early stages, programmes may be transmitted, but it is not anticipated that this experimental station will undertake a regular service. Satisfactory progress is being made with experiments in reception by the "spaced aerial" method. The success of Empire broadcasting depends mainly upon the possibility of transmission being re-radiated efficiently by local broadcasting stations, and it is therefore essential to devise a method of reception which will minimise the fading effect; signals from two or more aerials spaced at considerable distances apart may be combined and treated in such a way as to produce a more constant and undistorted signal. Taking into account the results of its last series of experiments, the B.B.C. sees no reason to revise its prediction that Empire broadcasting may be undertaken with the guarantee of the elementary conditions pre-requisite to service sometime during 1928. Contact is being maintained and developed with the broadcasting organisations of the Dominions and Colonies, while the chief engineer (now attending the World Wireless Conference at Washington) is evolving a further series of experiments in co-operation with the Radio Corporation of America.

Wireless Receiver Royalties.—Marconi Company's Concession.—At the inaugural banquet of the National Radio Exhibition, Sir Edward Iliffe, M.P., referred to the fact that many receiving instruments at present in use were out of date; he thought it would be greatly to the advantage of broadcasting generally if the possessors of those old sets could be induced to throw them away and invest in new ones. He understood that one of the reasons why old sets were not discarded was that a royalty had to be paid on each set purchased. and that a fresh royalty would therefore have to be paid for the new set. He suggested that the interests of listeners and of the wireless industry would be benefited if it were possible to induce the listener to discard his old set with greater frequency and purchase a new one, and that the necessary inducement might be a royalty rebate of, say, 50 per cent. when an old receiving set was discarded for a new one.

It is now learned that the Marconi Company has decided that in cases of listeners who already possess receiving sets being desirous of purchasing new ones employing the same number of valves, or more than are contained in their old sets, they will be credited with the whole of the licence fee they have already paid. The purchaser will then be called upon to pay a further royalty only on the number of valves fitted to the new set over and above the number used in the old set. The procedure will be that a listener wishing to discard an old set and to replace it with a new one, will obtain a declaration form (supplied to the trade by the Marconi Company) on application to the retailer from whom he proposes to purchase his new receiver: he will fill up the form and attach to it the royalty plate removed from his old receiver; the new receiver will then be sold to him with a royalty charge for the difference between that charged on the valves in the discarded set and those in the new set. A listener discarding a three-valve receiver and buying a new five-valve receiver will thus pay a fresh royalty of 25s. only instead of 62s. 6d. The concession comes into force immediately.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Armagh.—October 11th. Urban District Council. A.c. meters. (September 30th.)

Australia. — Melbourne.—Commonwealth Postmaster-General's Department. November 22nd. Insulated wire. (B.X. 3832.)*

November 28th. Telegraph instruments. (B.X 3835.)*

November 16th. Electricity Supply Committee. H.p. and l.p. 3-phase sub-station switchgear. (B.X. 3854.)*

Sydney.—November 7th. Municipal Council. High-voltage testing equipment. (Specification No. 1,154.)

December 7th. N.S.W. Government Railways. Three 5-ton and one 25-ton electric travelling cranes.

Avonmouth.—October 10th. Port of Bristol Authority. Electric lighting installation for the transit sheds and granaries at the Royal Edward Dock. (September 23rd.)

Barrow-in-Furness.—October 17th. Electricity Department. One 6,000-kW turbo-alternator with condensing plant, one water-tube boiler (60,000 lb. per hour), with mechanical stoker, or pulverised fuel plant, coal-handling plant and storage bunkers. (September 16th.)

Blackpool.—October 11th. Governors of Victoria Hospital. Second electric cable, Victoria Hospital. Specifications from Mr. W. J. Cunliffe, secretary.

Bognor.—October 17th. Bognor Gas and Electricity Co., Ltd. Rotary convertor, switchgear, transformers, e.h.p. and l.p. cables. (September 23rd.)

Bury.—October 12th. Electricity Department. Two water-tube boilers, with superheaters, economisers, mechanical stokers, coal- and ash-handling plant. (September 9th.)

Chile.—Santiago.—November 14th. Chilean Public Works Department. Plant for the Iquique Pintados Railway. Two 4-motor, 40-ton and one 3-motor, 5-ton electrically-operated overhead travelling cranes, "Selson" type, one 700-kg. capacity "Otis" type cargo lift. (A.X. 5198.)

Dartford.—October 15th. Electricity Works. One 750-kW synchronous induction motor generator, switchgear, &c. (September 30th.)

Dublin.—October 17th. Electricity Department. H.p. and l.p. circuit breakers for 12 months. (September 30th.)

Egypt.—Cairo.—October 26th. Ministry of Public Works. 7,500-kW thermal power station for Belgas. (B.X. 3748.)*

Egyptian State Railways, Telegraphs and Telephones. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, Westminster, S.W.1. Supply of the following telegraph and telephone materials:—16,000 galvanised-steel insulator spindles; 16,000 white porcelain insulator cups; 20,000 copper binders; 20,000 copper tapes.

October 27th. 44,349 metres armoured and unarmoured underground cables.

Greece.—Athens.—November 14th. Administrative Committee of the Port of Piraeus. Fifteen 2-ton harbour electric travelling cranes of the porch type. Specifications from the Commercial Department of the Greek Legation in London, 51, Upper Brook Street, W.1.

Grimsby.—October 26th. Electricity Department. Four kiosks and equipment. (See this issue.)

Haddington. — October 13th. East Lothian County Council. Electric lighting installation, &c., in connection with the alteration and reconstruction of police station and erection of constables' houses at Tranent. Specifications from Messrs. Dick Peddie & Walker Todd, architects, 8, Albyn Place, Edinburgh.

Hawarden. — October 13th. Electricity Department. E.h.p. and l.p. underground cables and fittings. (September 30th.)

India.—October 14th. Bombay, Baroda and Central India Railway Co. Porous Leclanché cells and zinc rods. October 21st. Electric overhead travelling cranes, &c. Forms of tender from the company's offices, The White Mansion, 91, Petty France, Westminster, S.W.1.

London.—Central Electricity Board.—October 24th. 132,000-V overhead transmission lines for the Central Scotland Electricity Scheme, 1927. (September 23rd.)

Metropolitan Water Board.—October 12th. Two 150-kW generators, switchboard, piping, &c., for Hampton pumping station. Chief Engineer, 173, Rosebery Avenue, E.C.

Southwark.—October 25th. Electricity Department. Cables for 12 months. (September 23rd.)

Paddington.—October 11th. G.W.R. Electrical apparatus (insulators, &c.) (September 30th.)

Manchester.—October 26th. Electricity Committee. One electrically-propelled tower wagon. (September 30th.)

October 14th. Four 250-kVA static transformers. (See this issue.)

October 11th. Board of Guardians. Electric battery truck, Withington Institution. Particulars from Mrs. Firth, matron of Institution.

Milford Haven.—October 17th. Electricity undertaking. Generating plant, switchgear, battery of accumulators, &c., underground and overhead mains. (September 23rd.)

New Zealand.—Dunedin.—November 12th. Corporation tramways. One overhead travelling crane, with 2-ton electric hoist. (A.X. 5179.)*

Nelson.—November 15th. City Council. 750-kW steam turbo-alternator and auxiliaries. (B.X. 3794.)*

Wellington.—November 15th. Postmaster-General's Department. Telephone cords. (B.X. 3836.)*

January 10th, 1928. Public Works Department. Additional 110,000-V switchgear, steelwork and control board for Arapuni Electric Power Supply. (B.X. 3837.)*

January 17th. 110,000-V switchgear, protective apparatus, steelwork, storage batteries, &c., for the Waikaremoana power scheme. (B.X. 3858.)*

January 12th. New Zealand Government Railways. One 2-ton and one 1½-ton capstans and one 2-ton battery crane truck. Two motor-driven air compressors. (A.X. 5254.)*

Salford.—October 14th. Electricity Department. H.p. and l.p. paper-insulated, lead-covered, and armoured electric power cable. City Electrical Engineer, electricity works, Frederick Road, Pendleton.

South Africa.—Durban, Natal.—October 17th. Corporation. Seven miles of combined pilot and telephone cable. (See this issue.)

Stockport.—November 11th. Electricity Department. One water-tube boiler with all accessories. (See this issue.)

Switzerland.—Swiss Federal railway authorities, Berne. 132-kV overhead transmission line between Rupperswil and Hendschiken and a 62-kV line between Kerzers and Biel.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Buntingford.—Board of Guardians. Accepted:—
Installing electric lighting at the Institution (£142).—North Metropolitan Electric Power Supply Co.

Brighton.—Board of Guardians.
Electrical fittings (£172).—H. J. Galliers.

Canterbury.—Town Council. Accepted:—
Two feeder cubicles and control panels (£401) and metering equipment (£286).—Ferguson, Pailin, Ltd.

Coventry.—
Electrical equipment of the greyhound racing track.—Greyhound Racing Track Construction and Supplies Co.

Croydon.—Board of Guardians. Accepted:—
Electrical fittings and appliances for 6 months.—Commercial Electric Co., Ltd. (Manchester).

Finance Committee. Recommended:—
Re-wiring Braithwaite Hall (£62).—A. E. Cooke.

Electricity Committee. Recommended:—
Borehole pump (£1,076).—Mather & Platt, Ltd.

Dundee.—It was stated at a meeting of the Electricity Committee that the lowest quotation for a supply of cable—that of a Belgian firm—was 31 per cent. under the lowest British offer and that in another instance the acceptance of a foreign offer meant a saving of £448 compared with the lowest British tender. The foreign tenders were accepted.

Hornsey.—Education Committee. Accepted:—
Electric lighting installation at St. Mary's Schools (£125).—Mr. A. E. Sandilands.

Ilford.—Electricity Committee. Accepted:—
Two transformer kiosks (£498).—Foster Engineering Co., Ltd. Two ditto (£484).—Metropolitan-Vickers Electrical Co., Ltd.

Lamp Contracts.—The Southern Railway Co. has placed a six months' contract for electric lamps with the General Electric Co., Ltd. Siemens Electric Lamps & Supplies, Ltd., has received a contract for vacuum and signal-type lamps for the Post Office (London) Railway.

Leeds.—Water Committee. Accepted:—
Electric motors and pumps.—At Dewsbury Road station (£497), Hathorn, Davey & Co., Ltd.; at Headingley station (£881), Drysdale & Co.

Tramways Committee. Accepted:—
Two miles of trolley wire (10¾d. per lb.).—Richard Johnson & Nephew, Ltd.

Electricity Committee. Accepted:—
Cables (£4,942), Enfield Cable Works, Ltd.; (£4,623), W. T. Henley's Telegraph Works Co., Ltd.; (£7,400), Macintosh Cable Co., Ltd.; (£647), Hackbridge Cable Co., Ltd.; and (£2,161), Greenwich Cable Works, Ltd.
Steel kiosks for sub-stations (£379), Yorkshire Switchgear and Engineering Co., Ltd.; (£126), English Electric Co., Ltd.

Mitcham.—Urban Council. Accepted:—
Installing the Gamewell system of fire alarms (£1,339).—G. Longfield-Beasley.

Penistone.—Board of Guardians. Accepted:—
Electrical supplies for six months.—G. H. Hinchliff & Co.

Salford.—Electricity Committee. Recommended:—
Piping for Agecroft power station (£2,470).—Babcock and Wilcox, Ltd.

Scarborough.—Electricity Committee. Accepted:—
Generating plant (£24,447).—Brush Electrical Engineering Co., Ltd.
Converting plant (£3,494).—Mather & Platt, Ltd.
Frequency changer plant (£3,295).—General Electric Co., Ltd.

Sheffield.—Electricity Committee. Accepted:—
1,650-kVA transformer (£1,212).—British Electric Transformer Co., Ltd.

Shipley.—Waterworks Committee. Recommended:—
Electric booster plant (£265).—Holden & Brooke, Ltd.

Forthcoming Events.

Diesel Engine Users' Association.—Friday, October 7th. Caxton Hall, Westminster, S.W. "Some Fuel Experiments in a Mechanical Injection Oil Engine." Mr. E. L. Bass.

Junior Institution of Engineers.—Friday, October 7th. 39, Victoria Street, S.W. 7.30 p.m. "Lubrication." Prof. E. Edser.
October 14th. "Problems Created by the Rapid Development of the Motor-car Industry." Mr. F. A. Simpson.

Illuminating Design Course.—Monday, October 10th. Lighting Service Bureau, 15, Savoy Street, W.C.2. 7 p.m. General inspection of Bureau. 7.30 Lecture on "Light Control."

Electrical Power Engineers' Association (Southern Division).—Saturday, October 8th. Hotel Cecil, Strand, W.C. 6 p.m. Annual dinner.

(Manchester Section).—Thursday, October 13th. Geographical Hall, Manchester. 7.45 p.m. "The Operation of Electrical Protective Devices." Mr. D. A. Murphy. Saturday, October 15th. Cheetham Town Hall, Manchester. 6.30 to 11 p.m. Social evening and dance.

E.D.A. Circle Campaign.—Monday, October 10th. National Luncheon at Edinburgh.

Institute of Transport.—Monday, October 10th. Institution of Electrical Engineers, London, W.C. 5.30 p.m. Presidential address by Mr. R. T. Smith.

Institution of Electrical Engineers (Western Centre).—Monday, October 10th. South Wales Institute of Engineers, Cardiff. 6 p.m. Inaugural address by the chairman, Mr. C. G. Morley New.

(Scottish Centre).—Tuesday, October 11th. Royal Technical College, Glasgow. 7.30 p.m. Inaugural address by the chairman, Mr. D. M. Macleod.

(South-Midland Centre).—Wednesday, October 12th. Grand Hotel, Birmingham. 7 p.m. Address by the chairman, Mr. W. Wilson, on "The Influence of Switch and Control Gear in Present-day Electrical Engineering," and "The Importance of Psychology in Engineering Progress."

Institution of Heating and Ventilating Engineers.—Tuesday, October 11th. Caxton Hall, Westminster, S.W. 6.45 p.m. "Atmospheric Pollution." Dr. J. S. Owens.

Institute of Marine Engineers.—Tuesday, October 11th. 85-88, The Minories, E.1. 6.30 p.m. "A New Form of Insulating Material for High Temperatures." Mr. A. F. C. Timpson.

Institute of Wireless Technology.—Tuesday, October 11th. Engineers' Club, W. 7 p.m. "The Design of a Resistance Capacity Amplifier for Broadcast Reproduction." Mr. G. L. Morrow.

Electrical Association for Women (Manchester Branch).—Conference. Thursday, October 13th. Lighting Service Bureau, Manchester: 10.30 a.m., "Electricity the Handmaiden in the Home," Dr. Christine Barrowman; address by Mr. J. W. Beauchamp. 1.15 p.m., Midland Hotel. Luncheon. 2.30 p.m. Visit to Messrs. Ferranti's Works, Hollinwood.

International Motor Exhibition.—October 13th to 22nd. At Olympia, W.

Institution of Engineering Inspection.—Friday, October 14th. Royal Society of Arts, Adelphi, W.C. 7.30 p.m. "Electric Power Cables and Recent Developments." Mr. C. M. Read.

Association of Supervising Electrical Engineers.—Saturday, October 15th. Mecca Restaurant, Ludgate Hill, E.C. Whist drive, dinner, and dance.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Era blocks (2 plate).
Glazebrook ironclad distribution board (mining type).
Wood blocks (for ceiling roses, switches, &c.), which must be of specially seasoned wood to withstand difficult climatic conditions.

Notes.

The Proposed Overhead Lines Association.

As announced in our issue of September 30th, p. 530, a general meeting will be held at the Institution of Electrical Engineers, London, on Wednesday next, October 12th, at 5 p.m., to decide whether a society shall be formed, and, if so, to set up an organising committee. In view of inquiries that we have received, we would emphasise the fact that this meeting will be open to all who are interested in questions relating to overhead lines; the ultimate scope of the membership, if it is decided to form an "Overhead Lines Association," will, of course, be a matter for the meeting to settle.

An Electric Liner.

There was launched at Newport News, Virginia, on October 1st, a new American electric ship, *California*, the largest commercial liner ever built in the United States. She will run on the Panama-Pacific line, between New York and the West Indies and California and Panama, says the *Financial News*. The vessel is one of 22,000 tons, and she has a maximum speed of over 20 miles an hour. Oil will be burned for steam to generate electricity for the motive power, light, cooking, lifts, and ventilation. She has eight decks and a garage for 140 cars.

The Fuel Conference, 1928.

A meeting of the International Executive Council, World Power Conference, was held at Cernobbio, North Italy, from September 5th to 10th, 1927. Representatives of 25 countries were present, the British delegates being Mr. D. N. Dunlop, chairman, International Executive Council, and chairman of the British National Committee; Mr. Ll. B. Atkinson, member of the British National Committee; Mr. R. T. Smith, member of the British National Committee and of the Technical Committee of the Conference; Dr. E. W. Smith and Mr. E. J. Fottrell, joint technical secretaries of the Conference; and Mr. M. W. Burt, secretary, International Executive Council, and joint general secretary Fuel Conference, 1928.

A number of conversations took place regarding the Technical Programme of the Fuel Conference, from which it was evident that the programme had been very favourably received, and that the Conference had already aroused widespread international interest.

Dr. E. W. Smith, joint technical secretary, in addressing a special meeting on September 10th, speaking on behalf of the British Committee, said that the technical programme was only to be regarded as indicating the scope of the Conference, and was not the programme of papers.

The British Committee did not wish to dictate regarding individual contributions, but it was hoped, as the result of the conversations with international representatives, that it would be possible to decide what contributions should be made by each country. If each country were to attempt to

cover the whole programme, the Conference would be far too large. Each country had its own problems, and its own specialist subjects, and it was hoped that each country would make its own essentially national contribution, with the object of pooling knowledge and experience internationally. Each country was invited to submit to the British Committee a skeleton of each paper it was proposed to present, for a preliminary exchange of views regarding the subject matter. The Conference was not to be a theoretical Conference; it was hoped that it would be of a thoroughly practical nature, based on sound technical lines directly related to practical economics.

The Volta Solemn Commemoration was held on Sunday, September 11th, and a telegram was sent to H.M. the King of Italy, and to the Prime Minister, H. E. Benito Mussolini, to the effect that the International Executive Council of the World Power Conference, representing forty-five countries, assembled at Cernobbio, sent greetings and desired to pay homage to Volta, the great Italian.

Conference on Methods of Coal Analysis.

The British Engineering Standards Association announces the calling of a conference, resulting from a request of the Committee of the Privy Council on Scientific and Industrial Research, that British National Standard methods of coal analysis should be adopted. It is suggested that Report No. 7, "Methods of Analysis of Coal," as drawn up by the Fuel Research Board, should be used as a basis for the preparation of a British standard specification for national use. The conference is being called for the purpose of ascertaining if there is a consensus of opinion in favour of setting up a B.E.S.A. Committee to deal with the subject, and delegates have been invited to attend from all interested bodies.

The Committee of the Privy Council states that the question of methods of analysis is one of increasing importance owing to the growing tendency to purchase coal to specification, and this is especially so in respect of foreign purchasers. It considers that the national adoption of standard methods of analysis would be of considerable advantage, both to the producers and the users of coal.

Golf.

The annual golf competition among members of the C.M.A for a cup presented by Sir George Sutton, Bart., was held on Thursday, September 29th, at Addington Golf Club. The competition was a bogey round, and the result was a tie between Mr. A. T. Gillanders (Standard Telephones & Cables, Ltd.) and Mr. C. Stewart (Johnson & Phillips, Ltd.). On playing off the tie the winner was Mr. Stewart. Unfortunately the day was very wet.

A M.O. Prefers Electricity.

In a recent letter to the Lichfield Board of Guardians, Dr. F. M. Rowland, the medical officer, severely criticised the action of the Board in proposing the restoration of the existing gas installation in the workhouse infirmary in preference to electricity. He described this as a retrograde step, and scarcely an advancement upon the days of Florence Nightingale.

National Electricity Supply.

Some interesting comments on the Electricity Act of 1926 were made by Major E. Ivor David, M.I.E.E., this year's president of the South Wales Branch of the Association of Mining Electrical Engineers, in his address at Cardiff on Saturday last. Under this Act a Board had been inaugurated to control all public supplies of electricity; once politicians entered any field, said Major David, distortion and misrepresentation became the rule. Every effort was made to fix the blame on the opposite party, and little was done to improve matters. Legislation was nearly always restrictive—seldom constructive. Thus, in "Coal and Power," page 94, para. 36, the price of energy in the N.E.S. was given as a little over a farthing in 1924. The average figure was actually 0.78d.—an error in the third degree! Again, Mr. Merz stated that the coal consumed in colliery furnaces could be reduced to one-fifth, if the required power were produced in large modern stations, and Sir Richard Redmayne stated in 1915 that "the present requirements of the country could be met by utilising one-third of the coal consumed at present." Figures were not available for 1915, but in 1923 the average consumption per unit generated was 2.73; in 1924 2.67; in 1925 2.53 lb. of coal. Assuming that it was 3 lb. in 1915, one-third of this was 1 lb.—an absurd figure for 1915, and not achieved in the present day. In the eyes of the politician everything black was fuel. Thus, on page 97, para. 47, the pit rubbish heaps were to be used by super-power stations. They could not get them to use washed coal—much less rubbish heaps. Our railways had been grouped under Government orders, with the result that rates were going up and the service was rotten. Power stations were going to be grouped under Government orders. Holding together electrically the many lines and generating units that would be involved in the Board's plan was the most difficult and technically complicated problem of the electrical industry to-day, and not one member of the Board had any experience of it. The two great industries of the country—iron and steel manufacture and mining—far and away the greatest potential users of electrical power, had no direct representation on the Board. These industries in the highly organised States of America used 50 per cent. of the total power produced, yet in this country they had no voice in the control of supply. Not one member of the Board had any experience of really cheap unit production. The two actually in touch with the management of power supply companies had experience of Metropolitan conditions only, where costs and charges were notoriously high. The ideas of the Board were based upon municipal supply systems, which amounted to only 11 per cent. of the total in highly developed states, and they appeared to have no knowledge of the large outputs produced by private concerns for their own use. No provision had been made for their participation in the general scheme. The private plants, for many reasons, produced power at lower costs than the public supply companies (or authorised suppliers), and they would have to be considered in the ultimate cheap universal supply. A spirit of co-operation must extend to include every producer as well as every user. At some time or another, in every day, all producers had some surplus power. If this could be passed into the national grid at a price corresponding to its actual cost, plus a reasonable profit, it would tend to reduce the total cost per unit. Private concerns could not entertain any form of control. Their plants were laid out to supply their own requirements, and continuity of supply to their own machines was more important to them than slight profits on surplus units, but a reasonable attitude by the Board and an appreciation of the private concerns' position might result in benefits to both sides. The private concern could reduce its spare plant, or even draw from the grid during its peak load, thus reducing capital expenditure and increasing efficiency by running plant at or near full load continuously. Where transport charges were high it would often pay to burn low-grade fuel at the mine, producing electric power. Low-grade fuel required high-grade plant to burn it efficiently, and the members of that Association would have the job of developing that plant.

The president of the Association, Mr. G. M. Harvey, made his official visit to the South Wales Branch, and presented Major David with the Association's gold medal for the best paper read before any branch during the last session ("Protection of A.C. Systems Against Short Circuits"). He also presented the branch second prize to Mr. T. J. Nelson for his paper, "The Education and Training of Mining Electrical Engineers." It was announced that the branch first prize, to Mr. C. E. Yates for his paper "Electrical Costing Applied to Collieries," would be presented at the Western Sub-Branch meeting at Swansea on October 15th.

Mr. G. M. Harvey congratulated the branch and the retiring chairman, Mr. Dawson Thomas, on being the strongest in the country, both as regards membership and the number of certificates obtained. Out of a total of 273 certificates issued since 1923, 66, or nearly 25 per cent., had come to South Wales.

Birmingham Electric Club.

The opening meeting of the Birmingham Electric Club, which was held at the Grand Hotel, Birmingham, on September 23rd, was well attended, and there is every indication that the new season is going to be one of increased interest. A large attendance is expected at the Annual Ladies' Evening on Friday, October 21st.

A paper, on "Light and Colour," was given by Mr. R. G. Williams, of the Holophane Co., Ltd. The lecturer dealt comprehensively with most phases of modern electric lighting, and briefly reviewed the wide field which awaits the efforts of the electrical illuminating engineer; he showed by means of lantern slides how pleasing results could be obtained by the judicious use of coloured light, and described in detail new methods of colour lighting for the interior and exterior of buildings.

A 25,000-h.p. "English Electric" Turbo-Alternator.

The English Electric Company has just delivered to the Willesden power station of the London Power Company an 18,750-kW turbo-alternator to run at 1,500 r.p.m. The total weight of the alternator exceeds 100 tons; the stator contains forty thousand pieces of steel, and the windings more than ten miles of copper strip. The company is at present engaged on a considerable number of main generating sets for large power stations at home and abroad, and, taking into account only sets of more than 5,000 kW, the aggregate capacity in hand exceeds 250,000 kW.

Educational.

University of London.—A course of four lectures on "Heat Transfer in Reciprocating Engines, including Internal Combustion Engines," will be given by Prof. Dr. A. Nägel at the Institution of Civil Engineers, Westminster, S.W., on Tuesdays and Fridays, October 11th, 14th, 18th and 21st, at 5.30 p.m. Admission will be free without ticket. (See our advertisement pages to-day.)

The Electrical Association for Women.

Manchester Branch.—A conference is to be held on October 13th. At 10.30 a.m. a lecture on "Electricity the Handmaiden in the Home," will be delivered by Dr. Christine Barrowman, and will be followed by an address by Mr. J. W. Beauchamp, director E.D.A., at the Lighting Service Bureau, 4, Fountain Street, Manchester. At a luncheon at the Midland Hotel the Lord Mayor (Alderman J. H. Swales) will preside, and will be accompanied by the Lady Mayoress. In the afternoon members and friends will visit Messrs. Ferranti's works, Hollinwood. The hon. secretary is Mrs. Harcourt Williams, "Woodville," Ack Lane, Bramhall.

Appointments Vacant.

Electrician for the Clayton Urban District Council. Plumber-jointer for the Walton-on-Thames Urban District Council Electricity Department. Assistant mains engineer ($400 per month+; $=2s. 4d.) for the George Town, Penang, Electricity Supply and Tramways Department; examiners of applications for patents for mechanical engineering, electrical engineering, and chemical inventions for the Minister for Industry and Commerce for Ireland; transformer station engineers (£400) for the Hydro-Electric Development of the Shannon Scheme. (See our advertisement pages to-day.)

B.E.S.A. Publication.

A new British Standard Specification recently issued by the British Engineering Standards Association, which will be of value to a wide field of industry, is for the dimensions of ball bearings and parallel-roller bearings. Tables of dimensions are given for all the stock sizes of thirty-five types of journal and single- and double-thrust bearings in general use, and both inch and metric sizes of bearings are included. Only the exterior dimensions of the bearings are dealt with. The specification does not cover the internal dimensions and the design of the bearings, nor the materials which enter into their composition. The tolerances on the dimensions are specified, together with tables of permissible errors due to wobble and eccentricity. Every bearing has been allotted a definite reference symbol, these symbols being compounded in such a manner as to make it possible to identify immediately both the particular type and size of a bearing from the symbol without reference to any form of index. These symbols should prove of value whenever bearings are being ordered or referred to. A standard nomenclature for the complete bearings and their component parts is included also. It is intended to supplement this specification at a later date by the issue of further specifications for the dimensions of taper-roller bearings, and for such other types of ball and parallel-roller bearings as may be found desirable. Copies of the specification may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, London, S.W.1., price 2s. 2d. post free.

The International Radio-telegraph Conference.

We have received the following cablegram from our representative at the Conference:—

The International Radio-telegraph Conference was opened in Chamber of Commerce Building at Washington on October 4th by President Coolidge, who cordially welcomed the Conference on behalf of the people of the United States. Having outlined the importance of means of communication to civilisation and pointed out that radio could properly fulfil its mission only by the aid of international regulations, he expressed confidence that the Conference, by candid discussion and wise co-operation, would render radio an increased power in the service of humanity. The Conference having vigorously acclaimed the President's address, Mr. W. Kruyt, of the Dutch Telegraph Administration, and doyen of the Conference, expressed thanks for the President's generous welcome, and proposed Mr. Herbert Hoover, Secretary of Commerce and Head of the United States Delegation as President of the Conference. Mr. Hoover took the chair, and said that the presence there of delegates from over seventy sovereign nations and representatives of over forty communication companies was the highest proof of the outstanding importance of radio communication. He sketched its amazing growth since the last Convention of 1912, and said that developments necessitated international understanding on the use of limited number of other channels available if the progress of this great branch of communications was not to be retarded. The allocation among different international services of whole bands of frequencies, from the highest to the lowest practicable, would be one of the major tasks of this Conference. He stressed the fact that the United States had, from the very nature of its constitutional organisation, left the creation, ownership, and management of its communication systems to private enterprise, and was glad of the presence at the Conference of representatives of the great companies which had so largely contributed to the growth and high efficiency of radio service; it was wholly fitting that they should be heard when policies to which they must conform were being determined. Progress in radio had not ceased, and he looked forward to great advances; while international agreements were necessary to orderly conduct, care was needed that regulation did not hamper progress. The Conference had great responsibility, but, if successful, would aid in spreading that human understanding which was the foundation of peace. The Conference stood in silence during the roll-call of deceased members of the last Conference. Colonel T. F. Purves, head of the British Delegation, expressed the pleasure of the Conference at being assembled in Washington, and gratitude to Mr. Secretary Hoover for presiding, and reported to the Conference on the administration of the Convention; since the last Conference in London forty-three Governments had signed the 1912 Convention, and ninety-seven now adhered thereto. After the announcement of the arrangements for the next meeting, the Conference adjourned till Wednesday, October 5th. The Conference numbers close on four hundred, and, in addition to considering every aspect of radio communication, there are at the Conference representatives of various bodies to which international agreements on radio matters are of vital importance; telegraph and cable companies, shipping and commercial interests are represented, as well as amateurs and professional operators. Washington has been sweltering in a heat wave, which fortunately shows signs of abatement, as, with the thermometer in nineties, such weather does not conduce to the dispassionate consideration so necessary for the successful solution of the many knotty problems that confront the Conference.

Patents and Trade Marks in the Irish Free State.

Mr. H. Thompson, secretary and registrar of the Chartered Institute of Patent Agents, draws attention to the fact that the new Industrial Property Act of the Irish Free State came into force on October 1st as regards patents, designs, and trade marks. Although a period of six months is allowed for taking steps to register rights under existing British patents, it appears probable that this period of grace applies only to the payment of the first fee, and there are many cases in which a renewal fee for a further year will have become due long before this period expires. In such cases the only safe course, he says, is to take steps at once to register the patent rights in Dublin, so that any further steps necessary to maintain the rights can be taken in good time. Holders of British patents, designs, and trade marks who contemplate protecting their interests in the Irish Free State under the new Act will be well advised to communicate promptly with their patent agents in order to ensure that no necessary precautions are overlooked. A notice as to the coming into force of the Irish Industrial Property Act appeared in the official *Journal of Patents* recently.

Electroculture Experiments.

Interesting results have attended a series of experiments in electroculture in the raising of crops, which have been carried out by Mr. A. R. Hill, headmaster of the Chuckery Senior School, Walsall, where scientific gardening is one of the special subjects of the curriculum. Crops have been grown under a network of aerial wires charged with electricity. At a show of vegetable produce held at the school a few days ago, potatoes were shown grown by this method which were heavier, sounder, and of healthier appearance than those grown under ordinary conditions, while peas also which had been subject to electroculture were shown to have made better and more rapid progress than those grown in the ordinary way. The experiments are to be continued.

Swaine] **The E.D.A. Circle Campaign Inaugural Luncheon at the Hotel Cecil, London.** *[London.*

A Tribute to Foamite Fire Extinguisher.

Owners of oil and petrol engine plant who have to carry stocks of these highly inflammable liquids, and engineers who use oil switches and transformers, will be interested in the following account of a fire which occurred at a branch depôt of Messrs. Studebaker, Ltd., Great Portland Street, London, on Sepember 22nd, and which was speedily extinguished with Foamite. It appears that an employé was filling a car with petrol in the basement from a can, when his boot struck a match, and immediately the petrol can caught fire. The employé attempted to throw the can out of the building, but the handle came off and the petrol spread across the floor, which was immediately a sheet of flame. The bulk of the petrol spread under a car containing 15 gallons of petrol. On hearing the commotion, the manager, Mr. S. Hunt, went downstairs and saw that the whole place was one big blaze. He telephoned for the Fire Brigade, who arrived within three or four minutes, and Mr. Hunt states that within five minutes of the Fire Brigade men arriving they were all out of the building, the whole fire being extinguished by the use of two cylinders of Foamite. He adds that when he saw the basement ablaze he gave the order for everyone to leave the building, and would not have given anything for any of the cars that were there at the time.

The International Electrotechnical Commission.

The preliminary report of the meetings of the I.E.C., recently held in Italy, shows that the outstanding decisions reached at the meetings were as follows:—

1. The definite adoption of rules relating to hydraulic turbines.
2. The completion of the revision of I.E.C. Publication 34, "Rules for Electrical Machinery," which will be submitted for adoption under the six months' rule, in order to avoid waiting for the next Plenary Meeting.
3. The adoption of the Report of the Heat Engine Trials Committee of the Institution of Civil Engineers as a basis for the preparation of an international code.
4. Agreement reached for reference to national committees with regard to dimensions for radio valve bases which, if adopted, will secure complete interchangeability between all valves made in Europe.
5. Agreement reached that the minimum test voltage for insulators be in accordance with the formula: $U_t = 2U + 10{,}000$ V.

Loughborough College.

On Saturday last "Presentation Day" was held at Loughborough College. In the course of an address, Lord Riddell said that until he met the Principal, Dr. H. Schofield, he had never heard of Loughborough College, and had no conception of the magnificent plant which it owned, no conception of its size and of the fundamental idea that was being carried out of teaching engineering as a human institution. Technical knowledge was essential for persons engaged in technical work, but no one could hope to be a real success in engineering unless he possessed certain other things: personality, the power of organisation, the power of managing men, tact, and courage. In addition to those things, students of the College, notwithstanding their educational advantages, had to develop character. Loughborough College comprised first-rate technical instruction, attention was paid to the development of character, and it had the qualities which were essential for success. The work achieved was a great thing for British industry.

Institution Notes.

Institution of Electrical Engineers.

A card containing the dates of meetings in London has been issued. The first ordinary meeting is on October 20th, the first "informal meeting" on October 24th, and the first Wireless Section meeting on November 2nd.

Society of Engineers (Incorporated).

A paper on "The Lead Electric Accumulator in Practice" was read by Mr. R. C. Hall, A.M.I.E.E., at a meeting on October 3rd. The author gave a brief summary of the history of the accumulator, followed by a study of its construction and operation. The necessity for great purity of materials was emphasised, and certain important improvements were described.

Institution of Heating and Ventilating Engineers.

The programme for the new session has just been issued; it includes a paper by Dr. J. S. Owens, M.D., A.M.Inst.C.E., on "Atmospheric Pollution," to be read at Caxton Hall, Westminster, on October 11th, at 7 p.m. The secretary is Mr. H. B. Watt, 12, Russell Square, W.C.1.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. William T. Taylor, M.Inst.C.E., M.I.E.E., who has for the past five years been managing director of undertakings in South America, is now settling in London. Practically the whole of his professional career has been devoted to the construction, operation, and management of large electric power transmission systems, and his latest book, "Overhead Electric

Mr. William T. Taylor.

Power Transmission Engineering," recently released from the press and reviewed in our issue of September 16th, 1927, p. 486, would seem to have come before the profession at a most opportune time. Mr. Taylor is a Lancashire man, and is a Freeman of the City of London. His address is: 65, Summerlee Avenue, London, N.2.

It is stated that Sir John Nicholson is retiring from the office of chief engineer for docks under the London and North-Eastern Railway at the end of this year, and he will be succeeded by Mr. J. A. Wickham, at present assistant general manager and industrial agent.

East Ham Town Council has increased the basic salary of Mr. W. R. Elliott, engineer and manager of the electricity and tramway undertakings, from £800 to £900 per annum.

Mr. C. E. Bennetts, assistant engineer to the Ross-shire Electric Supply Co., Ltd., has been presented by the indoor and outdoor staffs with a wallet of Treasury notes on the occasion of his marriage.

The Dover Town Council has decided to pay the borough electrical engineer, Mr. Harpur, an additional £80 per annum in lieu of free living accommodation, and he is to be allowed free electricity for lighting purposes up to a maximum cost of £12 per annum.

Mr. W. E. Lane notifies us that his business address is now 27-28, Finsbury Square, London, E.C.2. Telephone: "Clerkenwell 6136."

Mr. Harold F. A. Kinder, A.M.I.E.E., is sailing by the *City of Paris* on October 22nd to take up a position as resident engineer with the United Provinces Electricity Supply Co. in India.

M. E. Brylinski, chief delegate of the Syndicat des Producteurs et Distributeurs d'Energie Electrique, of Paris, has just been appointed a Commander of the French Legion of Honour; M. C. Goetz, the chief engineer of the Société Alsacienne de Constructions Mécaniques, of Mulhouse, and M. S. L. Poitrinal, technical director of the Société Electro-Cable, of Paris, have also been appointed Chevaliers of the same Order.

Wrexham Town Council has appointed Mr. J. W. Williams, station superintendent, as acting electrical engineer, and Mr. E. O. Jones, shift engineer, as station superintendent.

Fareham Urban Council has appointed Mr. C. Fry as assistant at the electricity sub-station. There were 17 applicants for the post.

Miss Nora E. Miller, who has been with the Edison Swan Electric Co., Ltd., for the past 12 years, has been appointed publicity manager to that company following upon the resignation of Mr. J. McGowan, who has returned to Scotland to take up the managing directorship of a Scottish advertising agency.

Mr. R. Wilson Jones, A.M.I.E.E., electrical engineer, F.M.S. Railways, Seutul, Kuala Lumpur, Federated Malay States, who is shortly returning to that country, wishes to receive there catalogues (with prices and discounts) of a.c. and d.c. motors (workshop types), small generators, and electrical accessories in general.

According to a Shanghai paper, Mr. T. H. U. Aldridge, engineer-in-chief of the Shanghai Electricity Department, left for home on July 15th.

Mr. A. L. Green, assistant secretary of the North-Western Centre of the Institution of Electrical Engineers, has removed to 244, Brantingham Road, Chorlton-cum-Hardy, Manchester.

According to *The Times*, Mr. P. J. Pybus has resigned the chairmanship of the English Electric Co., Ltd., "in order to undertake further public work." Mr. W. L. Hichens has accepted the chairmanship, and Sir Chas. Ellis will continue as deputy chairman. Mr. Pybus will, it is stated, remain on the board and continue to represent the company on its associated concerns.

The Leeds Corporation Electricity Committee has appointed Mr. T. C. Holdsworth as showroom assistant at £260 per annum. Mr. R. Rodgers has been appointed mains engineer at £260 per annum. The Corporation Tramways Committee has appointed Mr. George Babb as chief motor inspector and traffic inspector at £320 per annum.

Mr. N. G. Barraclough, electrical engineer, Workington, Cumberland, and Miss Annie Barbour, of Tallantire Hall, Cockermouth, were married on September 7th, and are now residing at Jenkin Hill, Thornthwaite, Keswick.

Mr. A. C. Bostel, sales manager to the Hackney Borough Council Electricity Department, has been appointed trading superintendent to the County of London Electric Supply Co., Ltd.

Mr. R. C. Teago has rejoined the staff of Messrs. Johnson and Phillips, Ltd., as v.i.r. cable sales engineer in the Midlands. His headquarters will be at Suffolk House, Suffolk Street, Birmingham.

Obituary.—Prof. Lehfeldt.—Dispatches from South Africa report that at the inquest on Professor Lehfeldt, of the Witwatersrand, the jury returned a verdict of "Death from electrocution."

Mr. S. Crosswood.—The death has taken place at the age of 77 years of Mr. Samuel Crosswood, who was for 23 years an electrical engineer with Newtons, Ltd., Taunton.

Mr. H. Le Fanu.—The death recently occurred at Charleroi, Belgium, of M. Henry Le Fanu, chief engineer of the Société des Ateliers de Constructions Electriques de Charleroi. The deceased, who was only 56 years of age, was born in Dublin, and was educated at Cassel and Munich, Germany. As a young man he was for six years with the Brown, Boveri Co. in Switzerland, joining the Belgian Société Electricité et Hydraulique in 1899, and on its formation, the Charleroi Co., in whose service he subsequently remained, rising to the position of chief engineer.

Mr. H. R. Prosser.—The death is announced of Mr. Harry Reginald Prosser, of King's Heath, at the age of 54. He was the managing director of the Etna Lighting and Heating Co. He had spent the greater part of his life in Birmingham, and a number of years ago was connected with the engineering side of the tramway undertaking.

Mr. H. W. Bagot.—The death is announced, following an operation, of Mr. Herbert W. Bagot, a director of Messrs. Claude Hamilton, Ltd., of Glasgow. Mr. Bagot, who had been connected with the firm for 30 years both in Aberdeen and Glasgow, was Mr. Hamilton's chief assistant, and was appointed a director a number of years ago. On the death of the founder in 1919 Mr. Bagot took charge of both the electrical and motor-car sides of the business.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Voltron Co., Ltd.—Private company. Registered September 22nd. Capital, £1,000 in £1 shares. Objects: To acquire the manufacture and sale and enter into arrangements for the exploitation of the "Voltron Valve," to take over the trade mark "Voltron," to adopt an agreement with W. H. Murad, and to carry on the business of valve dealers, manufacturers and agents, and manufacturers of and agents for wireless goods, &c. The directors are: W. H. Murad, 74, Lissenden Mansions, Highgate Road, N.W.5, valve manufacturer; H. G. Furlong, M.I.E.E., Beechwood, Grove Park, S.E.12, consulting engineer. Qualification: 1 share. Registered office: 169, City Road, E.C.1.

Richard Elleray, Ltd.—Private company. Registered September 29th. Capital, £500 in £1 shares. Objects: To carry on the business of wireless engineers and manufacturers, dealers in wireless apparatus, &c. The first directors are:—R. H. Elleray, Spring Bank, Lyth, Kendal; H. G. Seagrave, Water Dale, Storth, Milnthorpe, Westmorland; C. W. Rhodes, 53, Striclandgate, Kendal. Qualification: 50 shares. Registered office: Beagon Buildings, New Road, Kendal.

Electrical Enterprise, Ltd.—Registered as a "public" company September 29th. Nominal capital £30,000 in £1 shares (15,000 preference and 15,000 ordinary). The preference shares are entitled to a fixed cumulative preferential dividend of 5 per cent. up to December 31st, 1928, 6 per cent. for the year ending December 31st, 1929, and 7 per cent. for each subsequent year, and the right in a winding up to all arrears of dividend and return of capital, but are not entitled to any other rights in the profits or assets. The objects are: To acquire (a) the business carried on at Bungay as the "Bungay Gas Works," (b) the electricity undertaking operating in conjunction with the Bungay Gas Works, and (c) the Burnham-on-Crouch and District Electricity Special Order, 1927 (subject to such consents as may be necessary), to adopt an agreement with Dr. J. A. Purves and to carry on at Bungay, Burnham-on-Crouch, and elsewhere, the business of an electric light company in all its branches. The minimum cash subscription is 2,000 shares. The directors are: J. A. Purves, Thorpe Hall, Eaton Rise, Ealing, W., consulting engineer; Laura A. Willson, The Jumbles, Mixenden, Halifax (director of Barker & Willson, Ltd.); A. R. C. Johnston, 87, Twyford Avenue, Acton, W., engineer; Mary M. Partridge, 16, East Southernhay, Exeter (director of M. Partridge & Co., Ltd.); Caroline H. Haslett, Kensington Court, W.8 (secretary of the Women's Engineering Society); J. N. A. Houblon, Bexford, Newbury, Berks. (managing director of the Jersey Electricity Co.). Qualification: £250. Remuneration as fixed by the company. Registered office: 13, Victoria Street, S.W.1.

Official Returns of Electrical Companies.

Herrick Durell & Co., Ltd.—C. A. Dodds, chartered secretary, of 3, Copthall Buildings, Copthall Avenue, E.C., was appointed receiver and manager on September 14th, under powers contained in floating charge dated August 20th, 1927.

Wm. Pool, Ltd.—Issue on September 5th, 1927, of £200 debentures, part of a series already registered.

Deansgate Electro Radio (Manchester), Ltd.—C. A. Leeming, of 11, Dartmouth Road, Whitefield, Manchester, ceased to act as receiver and manager on August 10th, 1927.

Cray Installations, Ltd.—H. E. Clark, of 3 and 4, Clement's Inn, W.C.2, was appointed receiver on September 19th, 1927, under power contained in debentures dated March 17th, 1921, in place of J. T. Matthews.

Chelsea Electricity Supply Co., Ltd.—Capital, £450,000 in 420,000 ordinary and 30,000 preference shares of £1 each. Return dated May 12th, 1927. 395,488 ordinary and 30,000 preference shares taken up. £218,850 paid on 188,850 ordinary and 30,000 preference shares. £206,638 considered as paid on 206,638 ordinary shares. Mortgages and charges: £72,380.

A. Hirst & Son, Ltd.—Capital, £20,000 in 100 preference and 1,900 ordinary shares of £10 each. Return dated May 19th, 1927. 100 preference and 1,220 ordinary shares taken up. £2,200 paid on 100 preference and 120 ordinary shares. £11,000 considered as paid on 1,100 ordinary shares. Mortgages and charges, nil.

Lymington Electric Light and Power Co., Ltd.—Capital, £30,000 in 1,400 preference and 4,600 ordinary shares of £5 each. Return dated April 27th, 1927. 1,285 preference and 4,600 ordinary shares taken up. £29,425 paid. Mortgages and charges: £9,000.

Brompton and Kensington Electricity Supply Co., Ltd.—Capital, £400,000 in £1 shares. Return dated May 12th, 1927. 358,466 shares taken up. £199,845 paid, £158,621 considered as paid. Mortgages and charges, nil.

Marshall Electrical Co., Ltd.—Capital, £3,000 in 2,300 preference and 700 ordinary shares of £1 each. Return dated February 9th, 1926 (filed June 23rd, 1927). 2,300 preference and 682 ordinary shares taken up. £2,300 paid, £682 considered as paid. Mortgages and charges, nil.

British Insulated Cables, Ltd.—Capital, £2,000,000 in 1,333,333 ordinary, 500,000 preference, and 166,667 unissued shares of £1 each. Return dated April 4th, 1927. 1,333,333 ordinary and 500,000 preference shares taken up. £1,406,008 paid on 1,033,658 ordinary and 372,350 preference shares. £427,325 considered as paid on 299,675 ordinary and 127,650 preference shares. Mortgages and charges: £700,000.

Ericsson Telephones, Ltd.—Capital, £500,000 in 199,970 preference and 300,030 ordinary shares of £1 each. Return dated April 13th, 1927. All shares taken up. £269,980 paid, being £1 per share on 50,010 ordinary and 199,970 preference, and 8s. per share on 50,000 ordinary shares. £230,020 considered as paid, being £1 per share on 200,020 ordinary shares, and 12s. per share on 50,000 ordinary shares. Mortgages and charges: £100,000.

West London and Provincial Electric and General Trust, Ltd.—Capital, £150,000 stock. Return dated May 13th, 1927. All stock taken up. £135,000 paid, £15,000 considered as paid. Mortgages and charges, nil.

J. T. Kemp, Ltd.—Satisfaction is full on September 23rd of debentures dated August 17th, 1927, securing £1,050.

Particulars filed of £4,500 debentures authorised September 23rd, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

City Notes.

Agricultural and General Engineers, Ltd.

The industrial troubles seriously affected the working of this group during the year ended March 31st last. The profit was £100,715, as compared with £173,239 in 1925-26, and after deducting depreciation, debenture interest, &c., there remained a balance of £13,310 (against £76,101). The revenue of the parent company amounted in all to £57,936, and the balance, after deducting expenses, was £4,013 (against £52,471). This is added to the balance brought in, and the total of £67,345 is carried forward. Meeting: October 14th.

Electrolux, Ltd.

The profit for the year ended June 30th last, after providing for depreciation, &c., was £46,231, and to this is added £2,966 brought forward, making £49,197. After deducting directors' fees, &c., it is proposed to pay a final dividend of 3½ per cent. on the "A" shares (making 7 per cent. for the year), to transfer £25,000 to general reserve, and to carry forward £6,302. Practically the whole of the capital is now paid up, and the directors consider that the initial difficulties in connection with the introduction of the "Electrolux" cleaner and refrigerator into this country have now been overcome. Meeting: October 6th.

In commenting upon the report, *The Times* says that the company's authorised capital is £1,000,000, of which £983,500 has been issued. "The balance sheet shows a bank overdraft of £190,710, and creditors and reserves against contingencies amounting to £67,794. The total of the balance sheet is £1,192,014. The largest item is the intangible one of patent rights and goodwill, which stand at cost, £500,000. This is a big figure in comparison with present earnings, but much depends upon the rate of progress. If expectations as to future earnings were seriously disappointed, it would have to be written down. The second largest item is debtors and payments in advance, less reserves for doubtful debts, and what is called forward profit on hire-purchase contracts. These total £394,454. Obviously a business of this character requires a considerable amount of working capital, for stocks and work in progress represent an additional £133,221. Cash in hand and in the bank amounts to £3,059."

Companies to be Struck off the Register.

The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Bower Electric (Bristol), Ltd.
Electricity (Scunthorpe), Ltd.
Radio Ebonite Supplies, Ltd.
Radio Stocks, Ltd.
S.W. Radio, Ltd.
Wellington Electrical & Radio Engineering Works, Ltd.
Williams-Stokes Wireless Co., Ltd.

West London and Provincial Electric and General Trust, Ltd.

An interim dividend of 4 per cent. has been declared on the ordinary stock.

Associated Telephone and Telegraph Co.

The usual quarterly dividend of $1.75 per share has been declared on the 7 per cent. preferred shares.

Midland Electric Corporation for Power Distribution, Ltd.

An interim dividend of 1s. per share has been declared on the ordinary shares, as in 1926.

Stanton Ironworks Co., Ltd.

The dividend for the half-year ended September 30th has been declared on the 6 per cent. preference shares.

Lancashire Electric Light and Power Co., Ltd.

An interim dividend at the rate of 7 per cent. per annum has been declared on the preference shares.

German Company.

The *German Electricity Works* (*Garbe, Lahmeyer & Co.*), Aix-la-Chapelle, reports gross profits of 1,172,000 marks for 1926-27, as compared with 2,013,000 marks in the previous year. The net result, however, is stated to be a loss of 683,000 marks, as against one of 394,000 marks in 1925-26, which has been covered by an appropriation from the reserve fund. The orders received in the current year have so increased that the directors hope to obtain improved results.

Stocks and Shares.

MONDAY EVENING.

IN the Stock Exchange the industrial market comes an easy first; the rest of the markets are far behind it in public attention. Interest in miscellaneous stocks and shares continues to run very high. The wild gamble in artificial silk shares suffered something of a check, but, although effervescence subsided, the extraordinary vitality of the market manifested itself in the close consideration paid to every fluctuation of a few pence in the shares of the popular varieties. Artificial silk, however, does not monopolise all the speculative excitement. During the last few business days, lively activity arose in Siemens shares, and the price spurted sharply to the accompaniment of reports to the effect that Siemens and Henleys are contemplating an agreement of interests. Probably the report will have received either denial or contradiction before these notes appear, but we may be permitted, perhaps, to refer to the vague idea, mentioned here some time ago, of a possible amalgamation of interest that will include all the big cable manufacturing and electrical equipment companies.

That Blessed Word—Agreement.

It may take years, as we said previously, for such a movement to materialise, but its possibility is one that is clearly present to the prophetic eye of the buyer of shares to-day. He, disregarding the modest yield obtainable from a purchase of shares on the present dividend bases, is content to lock up money in the good-class companies with the idea of seeing a substantial appreciation in his capital during the course of the next few years. It may be of service to repeat that, if there were to be in the future any such development, the division of assets through the formation of any big combine would involve re-assessment of the properties owned by the various constituent companies, in which re-assessment it is taken for granted that hidden reserves would stand revealed in a manner that would justify higher prices than prevail in the market to-day for the various shares. All this, of course, lies in the future, but with the modern tendency directed towards linking up interests in various important branches of industry, it is certainly not outside the bounds of possibility that there should be something of this kind established in an arm of trade which lends itself to inter-working arrangement and co-operation of effort.

Underground Bonds' Rise.

The strength of Underground Electric Railways of London income debenture stock stands out as a prominent feature in the Home Railway stocks. In fact, were it not for this, the list would make a poor showing, for business is listless and prices are dull. The buying of Underground Incomes rests upon the assumption that the option which these carry, in the shape of share conversion, has not yet been fully appreciated, and that the bonds are worth more than the present figure. The buying has been substantial, and a large line of stock was lifted from the market last account day. Meanwhile, the price of the shares moves more quietly. The argument is heard in the market that if the income bonds are worth the present price, the shares should be standing at least not below par. The demand so far has centred upon the bonds, and the improvement in the price of the shares is merely the reflection of the rise in the senior stock. There will be disappointment, however, if the shares do not follow, before long, the course which the bonds are now so strongly setting. The latter have gained 2 points: the shares are unchanged at 19s.

World Radio.

Marconis have suddenly shot into notice with a lively rise to 22s. 6d. The whole group is good. Canadians have risen to 6s. 6d. bid. Marconi Marines recovered the dividend deducted last week. The reason for this strength is to be found in the World Radio Conference that started this week in Washington, and to which Mr. F. G. Kellaway, managing director of the Marconi Company, was on his way, as we noted here, ten days ago. A report gained currency and credence in the Stock Exchange to the effect that one result of the Conference might be agreement between the Radio

Corporation of America and the Western Union. The latter is an American undertaking, and its shares change hands comparatively seldom in the London Stock Exchange. The last record of business done is at 165¼, on August 31st. Radio Corporations are quoted at 13 for the "A" common stock; the "A" preferred at 10½.

Cable Stocks.

British cable issues are not affected by the reported cable-wireless developments. Globe ordinary are harder at 18, and Westerns put on ¼ at 17⅞, these being ex the dividend of 5s. in each case. Eastern ordinary has recovered a point. Anglo-American Telegraphs have not changed. Great Northerns are being persistently bought from Copenhagen, and last week's rise of 25s. has been followed by a more dramatic gain of 55s., lifting the price to 34½. The "heavy" shares are good as a whole. Telegraph Constructions have added another 10s. to their price, bringing it to 29. The recent rises in these shares have served to revive hopes of some possible bonus for proprietors, either in cash or in the shape of a distribution of shares. It is a little surprising in these days for any company to retain the nominal value of its shares, as the Telegraph Construction does, in the clumsy denomination of £12 apiece.

Big Price Movements.

Remarkable rises have occurred in various traction and utility issues. Brazilian Tractions are no less than 12½ points higher at 211½. The preferred followed with a jump of 10, to 174. British Columbia Electric Railway deferred is 6½ up, at 177. Mexico Tramways 6 per cent. 50-year bonds put on 5, to 82½. A gain of 3 has left Metropolitan Electric Tramways 4½ per cent. debenture at 68½. This last is due to the success attendant upon the greyhound racing at Harringay. The movements in Colonial and foreign stocks are largely the result of dealings in Montreal, Paris and Brussels. The strength of Great Northern Telegraphs, already mentioned, is attributed to French demand. A few of the fluctuations are adverse to holders of the stocks. Mexican Light and Power common shares are 4½ lower at 56. But the company's 5 per cent. first mortgage bonds are 3 up, at 82½, and so are Mexico Tramways fives at 77. Perak Hydro-Electric advanced further into favour with a rise to ten-and-six. Pachuca firsts strengthened to 94½. The Rio Tramways stocks are very firm.

The New Electricity Scheme.

Publication of the South-East England electricity scheme served to arouse renewed interest, although the bare outlines of the Electricity Commissioners' proposals had been fairly well known in advance. From the Stock Exchange point of view they have made little immediate difference. There are no price changes of importance to record: a few ex-dividend markings have been recovered. The provincial list is hard, and Tees Power 6 per cent. debenture rose to 98 ex dividend. There are offered, at the moment, a moderate number of Midland Electric Corporation ordinary at 55s., paying £5 9s. 1d. per cent. on the money, the last dividend having been 15 per cent. North Metropolitan ordinary can be bought at 34s. 3d., to yield £5 16s. 9d. on the 10 per cent. dividend basis. Scottish Power paid 8 per cent. on the ordinary, and the shares at 26s. 3d. return £6 2s. per cent. on the money. The company's new shares are offered at 25s., and give a slightly higher return; the dividend at present is calculated on the instalment payments. Shropshire "A" at 28s. 9d. and the "B" at 27s. 6d. afford £5 11s. 4d. and £5 1s. 10d. per cent., respectively. In all these cases the yields are worked out upon the basis of the dividends paid by the various companies in the last completed year. The amounts of debenture stock on offer in the good London companies is extremely small. City of London Electric 5 per cent. debenture stands at 100, and can be bought at that price. County of London 5 per cent. debenture and London Power 5 per cent. registered debenture are available at 99½. Lancashire Electric 5 per cent. redeemable debenture, carrying a "broken" interest payable on December 1st, costs 98¾. This gives £5 2s. on the money invested at to-day's price.

Manufacturing, and Others.

Siemens went from 32s. 6d. to 34s. 9d., coming back about half-way. Henley's remain at a shade below £5. In General Electrics there is a fair amount of business doing. Babcock and Wilcox have gone ahead to 56s. 3d., to the accompaniment of rumours favourable but vague. Vickers improved to 11s. 10½d. on a talk of the capital being written up, by adding 3s. 4d. to the ordinary shares' present nominal value. It is not long since the shares were written down from £1 apiece to the 6s. 8d. at which they now appear. So far as the market price goes, this is unaffected by either a nominal reduction of, or increase to, the standing of any shares. But no responsible directorate would write up the nominal value of a company's shares unless they had such good reason as might be deemed to justify outsiders in taking a cheerful view of the outlook.

Rubber shares are weak by reason of a further decline in the price of raw rubber. Various new issues are contemplated for the public's consideration in the near future. There is no lack of money available for either investment or speculation.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Oct. 3 1927.	Rise or fall.	Yield, p.c.
Home Electricity Companies.						
Bournemouth and Poole	£ 1	14	14	58/3	—	4 15 9
Brompton Ordinary	1	10	8⅝	24/6	—	5 14 3
Charing Cross Ordinary	1	15	8½	25/6	—	5 9 10
do. do. 4½ Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	8¾	24/6	—	5 14 3
City of London	1	15	7½	29/3	—	4 15 9
do. do. 6% Pref. ...	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	32/6	—	4 18 6
County of London	1	15	7½	27/6	—	5 1 10
do. do. 6% Pref. ...	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	8	10	37/6	—	5 6 8
do. 7% Pref.	1	6	7	24/6	—	5 14 3
Elec. Supply Corporation	1	10	10	32/6xd	+9d.	6 3 0
Kensington Ordinary	1	15	8	25/6	—	5 9 10
Lancs. Light and Power	1	7½	7½	26/6	—	5 13 6
London Electric	1	10	8½	24/6	—	5 14 3
do. do. 6% Pref.	6	6	6	5⅝	—	5 11 3
Metropolitan	1	11	8	30/-	—	4 13 4
do. 4½% Pref.	1	4½	4½	17/-	—	5 8 6
Midland Counties	1	8½	6	22/6	+1/-	5 6 8
Newcastle-on-Tyne Ordinary ...	1	7	5	22/-xd	+6d.	4 11 0
do. 5% Pref. ...	1	5	5	17/6xd	+6d.	5 14 8
do. 7% Pref. ...	1	7	7	25/-xd	+6d.	5 12 0
Notting Hill 6% Pref.	10	6	6	10⅝	—	5 11 7
North Met. Elec. 6% Pref. ...	1	6	6	23/6	+6d.	5 6 8
St. James' and Pall Mall ...	6	17½	8	25/6	—	5 9 10
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1½	—	6 8 0
Urban Ordinary	1	7	7	1 5/16	—	4 9 7
do. 6% Pref.	1	6	6	1 1/16	—	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/9xd	—	7 4 7
Yorkshire Elec.	1	8	8	31/6	—	5 3 0
Home Rails.						
Central London Ord. Assented ...	Stock	4	4	70	—	5 14 4
Metropolitan	,,	5	8	56½	—	5 6 9
do. District	,,	3½	3½	61½	—	5 13 10
Underground Electric	£1	Nil	1½	19/-	—	1 11 7
do. do. Income ...	Bonds	6	6	105	+2	*5 14 3
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	1½	1½	25	—	6 0 0
Automatic Telephone	1	8	10	48/9xd	—	4 2 0
Chili Telephone	5	5	6	7⅜	—	3 18 3
Eastern Extension	10	10	10	17½	—	*5 14 3
Eastern Tel. Ord.	Stock	10	10	174½	+1	*5 14 7
Globe Tel. and T. Ord.	10	10	10	18xd	+½	*5 11 1
do. do. Pref.	10	6	6	10⅞xd	—	5 10 4
Great Northern Tel.	10	20	20	34½	+2½	5 16 3
Indo-European	25	8½	10	44½	—	*5 7 6
Marconi	1	Nil	Nil	22/6	+2/6	... ...
Marconi-Marine	1	7½	8⅝	28/9xd	+9d.	6 1 9
Oriental Telephone Ord.	1	12	12	52/6	—	*4 9 4
United R. Plate Tel.	5	8	8	10	—	*4 0 0
Western Telegraph	10	10	10	17½	—	*5 14 3
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	8½	—	7 17 2
do. do. 2nd Pref. ...	5	6	6	8 7/16	—	8 14 6
do. do. 5% Deb. ...	Stock	5	5	73½	—	6 16 1
British Electric Traction Def.Ord.	,,	8	8	500	—	... ...
do. do. 8% Pref. Ord.	,,	6	8	130½	−1	6 12 10
Brazil Traction	100	5	6	211½	+12½	2 16 8
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	90½	—	5 10 6
do. do. Preferred ...		6⅔	6⅔	135½	+1	4 12 3
do. do. Deferred ...	,,	8	8	177	+6½	*4 10 2
do. do. Deb. ...	,,	4⅔	4⅔	78½	−1½	5 8 3
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/-	—	Nil
London United Tram. Deb. ...	Stock	4	4	56½	—	7 1 7
Mexico Trams, 5% Bonds	—	5	5	77	+3	6 9 10
Mexican Light Common	100	Nil	Nil	58	−4½	Nil
do. Pref.	100	Nil	Nil	80½	—	Nil
do. 1st Bonds	—	5	5	89½	+3	6 1 3
Yorkshire (West Riding)	1	5	—	7/6	—	... ...
Manufacturing Companies.						
Babcock & Wilcox		12	18	56/3	+⅛	4 12 6
British Aluminium Ord.	1	12½	10	45/9xd	−6d.	4 7 6
British Elec. Transformer Pref. ...	1	Nil	7	18/3	—	7 13 6
British Insulated Ord.	1	15	15	8½xd	—	4 1 4
Brush Ord.	1	10	10	27/6	—	7 5 0
Callenders	1	15	15	8⅜	—	4 2 9
do. 6½% Pref. ...	1	6½	6½	23/9	—	5 9 8
Crompton Parkinson Pref. Ord. ...	1	Nil	Nil	16/-	—	... ...
Edison-Swan	£/-	10	10	10/-	—	4 0 0
do. 5% Deb. ...	Stock	5	5	88	—	5 13 3
Electric Construction	1	10	7½	28/9	—	5 4 4
Enfield Cable Pref.	1	7½	7½	25/-	—	6 0 0
English Electric	1	Nil	Nil	11/3	—	... ...
do. do. Pref. ...	1	8	—	13/9	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	7½	32/-	—	4 13 9
Henley	1	20	25	4 1/2	—	5 1 3
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	20/6	—	*4 17 7
Johnson & Phillips	1	17½	12½	50/-	—	5 0 0
Met.-Vickers Ord.	1	8	8	28/9	—	5 11 5
do. Pref.	2	8	8	2 7/8	—	6 4 8
Siemens Ord.	1	7	7½	33/6	+1/-	4 9 6
Telegraph Construction	12	10	10	29/-	+½	*4 3 6

* Dividends paid free of Income Tax.

Electrical Exports of the United States.

Two Years' Figures Compared.

BELOW are shown the values of electrical machinery and apparatus exported from the United States during the twelve months ended June last. Comparative figures for the twelve months ended June, 1926, are added and notes of increases or decreases are given.

	Twelve months ended June, 1926. Value. Thous. $	June, 1927. Value. Thous. $	Inc. or dec. Thous. $
Electrical machinery and apparatus (total)	80,676	83,008	+2,332
Generators—			
Direct current—			
Under 500 kW	874	986	+ 112
500 kW and over	410	460	+ 50
Alternating current—			
Under 2,000 kVA	251	192	- 59
2,000 kVA and over	2,068	1,122	- 946
Steam turbine generator sets	1,164	979	- 185
Accessories and parts for generators	1,126	978	- 148
Self-contained lighting outfits	1,057	1,274	+ 217
Batteries—			
Flashlight batteries	1,257	2,026	+ 769
Other primary batteries	1,641	2,258	+ 617
Storage batteries	3,087	3,537	+ 450
Transforming or converting apparatus—			
Power transformers	2,102	2,080	- 22
Other transformers	1,145	1,301	+ 156
Rectifiers, double-current and motor generators, dynamotors, synchronous, and other convertors	1,153	1,571	+ 418
Transmission and distribution apparatus—			
Switchboard panels, except telephone	2,922	984	-1,938
Switches and circuit breakers over 10 amps.	2,724	2,332	- 392
Fuses and fuse blocks	354	361	+ 7
Watt-hour and other measuring meters	478	469	- 9
Volt-, watt- and ampere-meters, and other recording, indicating and testing apparatus	1,870	2,089	+ 219
Lightning arrestors, choke coils, reactors, and other protective devices	742	706	- 36
Motors, starters, and controllers—			
Motors under 1 h.p.	2,132	2,190	+ 58
Stationary motors—			
1 to 200 h.p.	3,101	3,146	+ 45
Over 200 h.p.	858	565	- 293
Railway motors	785	1,099	+ 314
Electric locomotives—			
Railway	1,460	1,012	- 448
Mining and industrial	607	607	—
Starting and controlling equipment—			
For industrial motors	1,283	1,292	+ 9
For electric railway and vehicle motors	240	198	- 42
*Portable electric tools	259	748	+ 489
Accessories and parts for motors	2,667	2,197	- 470
Electrical appliances—			
Electric fans	875	1,054	+ 179
Electric lamps—			
Metal filament	1,402	1,688	+ 286
Other electric lamps	229	333	+ 104
Flashlights	1,794	2,175	+ 381
Searchlights and projectors	527	866	+ 339
Motor-driven household devices	1,379	2,193	+ 814
Domestic heating and cooking devices	1,476	1,635	+ 159
Industrial electric furnaces and ovens	247	299	+ 52
Therapeutic apparatus, X-ray apparatus, galvanic and faradic batteries, &c.	1,498	1,580	+ 82
Signal and communication devices—			
Radio apparatus—			
Transmitting sets and parts	340	374	+ 34
Receiving sets	6,721	3,116	-3,605
Valves	401	968	+ 567
Signal and communication devices (cont.)—			
Receiving set components	752	2,244	+1,492
Receiving set accessories	869	2,551	+1,682
Telegraph apparatus	602	1,117	+ 515
Telephone apparatus—			
Instruments	549	391	- 158
Telephone switchboards	1,782	1,166	- 616
Other telephone equipment	2,312	2,567	+ 255
Railway signals, switches, and attachments	547	617	+ 70
Bells, buzzers, annunciators and alarms	238	297	+ 59
Other electrical apparatus—			
Spark plugs, magnetos, and other ignition apparatus	2,398	1,865	- 533
Insulating material	1,546	1,337	- 209
Metal conduit, outlet, and switch boxes	1,012	1,089	+ 77
Sockets, receptacles and lighting switches	1,684	1,813	+ 129
Electric lighting fixtures, interior and street	1,721	1,789	+ 68
Other wiring supplies and line material	1,259	1,122	- 137
Electrical apparatus n.e.i.	7,097	8,003	+ 906

Exports during 1927.

A recent issue of *Commerce Reports* gave details of the United States foreign electrical trade during July. It is shown that the total value of exports during July was $8,536,610, a gain of $584,546 over the corresponding month of last year, and of $1,023,940 as compared with June. The larger increases recorded were for light equipment, although steam turbo-generator sets and accessories and parts for generators showed substantial gains. The principal increase ($185,385) was recorded by insulated copper wire and cable; batteries showed a rise of $176,110; and wiring supplies and line material one of $131,545. Exports of radio apparatus were valued at $619,380, as against $496,742 in July, 1926. Other classes which showed increases were fans, lamps, motor-driven household devices, domestic heating and cooking devices, railway signals, &c., switchboards, and mining and industrial locomotives. The classes which recorded decreases included generators (a.c. and d.c.), transforming and converting apparatus, motors under 1 h.p., switches and circuit breakers (over 10 A), and bare copper wire. During July the Western Hemisphere took $4,747,693 worth of the United States exports of electrical equipment, Canada being the largest individual buyer, taking approximately as much as all Europe. Brazil, Argentina, and Cuba were the next in importance, importing equipment valued at $737,027, $616,744, and $450,932, respectively. Exports to all three of these countries showed increases of over $100,000 as compared with the previous month, this year, Brazil's increase amounting to $445,861; Cuba taking $168,763 worth more and Argentina $105,160. Shipments to Mexico for July decreased $106,587 as compared with June. Exports to Asia, Africa, and Oceania during July increased by $275,016 as compared with the previous month. Australia was the largest importer of electrical equipment, taking goods valued at $690,170, which was a decrease of $14,221 compared with June. Japan's imports for July amounted to $454,931 as compared with $310,199 for June, and British India took equipment valued at $225,089, an increase of $46,792. Exports from the United States to New Zealand for the month of July increased $92,922. Trade in electrical equipment with European countries was slightly less during July than in June, registering a decrease of $71,028.

American imports of electrical apparatus during July amounted to only $158,127, consisting mainly of lamps from Japan and Germany; radio apparatus from Germany, Great Britain, and Canada; and electrical machinery and parts from Switzerland, Sweden and Germany. Germany's share was valued at $58,201, and that of the United Kingdom only $7,620 (practically all radio apparatus).

The total value of American electrical exports during the first seven months of the current year was $57,006,694, representing an increase of $994,774, as compared with the corresponding period of last year.

Another issue of *Commerce Reports* analyses the United States exports of radio apparatus to Europe during 1926. This shows that the total value was $1,269,142, and that Great Britain was by far the largest purchaser, with a share valued at $461,479, as compared with $155,923 for the second largest—Spain.

The Round Island Radio Beacon.

Details of a new wireless station for the assistance of navigation at sea, installed by Marconi's Wireless Telegraph Co., Ltd., for the Trinity House Authorities.

NEW radio beacons are now being constructed by the authorities of Trinity House at various points around the English coast. Their purpose is to transmit distinctive wireless signals at regular intervals which will enable vessels fitted with direction finders to take bearings and so accurately determine their positions. The installations are expected to prove of the greatest assistance to marine navigation when ships are approaching land, particularly during darkness and in foggy weather.

The first beacon station to be put into regular commission by Trinity House is situated on Round Island, Scilly Islands.

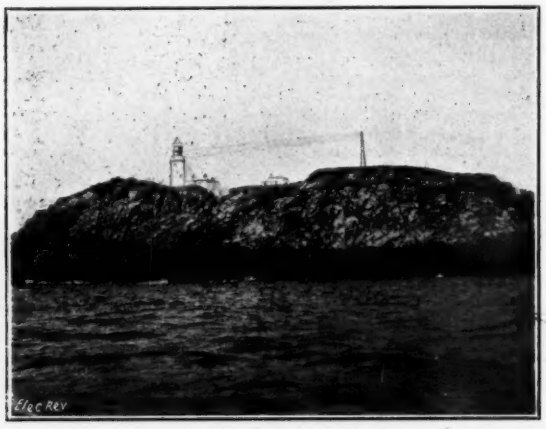


Fig. 1.—Round Island Radio Beacon Station.

This set has a power of 500 watts, and is operated on a wavelength of 1,000 metres, which is the specified wave-length for wireless beacon stations; its special call sign is the letters GGG in Morse code. The transmitter has been designed by the Marconi Company to the specifications of Trinity House, and the whole equipment is automatically controlled by a master clock for transmitting groups of i.c.w. signals at predetermined intervals. All running machinery is duplicated throughout, whilst a spare set of wireless valves is fitted on the main transmitter, with automatic switching arrangements.

A steel lattice tower, 60 ft. high, has been erected on the island, and the multi-wire inverted "L" aerial is supported between it and the lighthouse gallery (fig. 1) at an average height of about 50 ft. Fig. 2 shows (from left to right) the main switch with two automatic starters, underneath which are the motor-alternators, and three field regulators, above which is the main switchboard. To the right of this board are the two revolution indicators for the character-wheel motors; the field regulator for the latter is mounted just below and between these indicators. On the floor immediately under this are duplicate motors with their character wheels which form the automatic signalling key for the transmitter. To the right of the indicators is the character switchboard, which carries two master control-clocks which automatically start and stop the transmitter at specified intervals. On the table on the extreme right is the wireless apparatus, the three instruments being (from left to right) the closed-circuit inductance, the oscillation generator containing four valves, two of which are spare, and the aerial inductance. In the left-hand cupboard is the closed-circuit condenser, and in the right-hand one the power transformer.

Should either of the two T.250 valves in use burn out, a relay mounted on the panel will automatically bring the stand-by pair into operation and, at the same time, a loud-speaker alarm circuit will be completed to warn the attendant that one of the valves has become defective. The filaments of the valves are heated by means of a step-down transformer from the main motor-alternator. The circuit used in the transmitter is that commonly known as the "back to back" type, and consequently the note actually heard in the receiver corresponds to a frequency twice that of the alternating-current frequency. The transmitting unit is enclosed in an expanded-metal case, rubber matting being provided to avoid risk of shock.

The high-frequency apparatus provides for coupled-circuit working, and the signalling apparatus consists of duplicate master clocks mounted on a switchboard which also incorporates a relay operated by the clock for starting the motor-driven character wheel.

The signal for fair-weather periods consists of the call sign GGG repeated at the rate of 15 words per minute for 47 seconds, followed by a prolonged dash of 10 seconds duration and terminated by one repetition of the call sign, the whole transmission taking 60 seconds exactly. It is followed by a silent period of three minutes in each case, and is repeated three times, covering a total of nine minutes every half-hour. This sequence is carried out by the clock in the following manner:—

Just prior to the beginning of the transmission, contacts on the clock start the main alternator, which provides the whole of the power required by the transmitter; a second pair of contacts then energises the motor of the character wheel, and the actual periods of transmission are governed by mechanisms incorporated in the wheel. At the end of the third transmission the clock contacts open and the main alternator is switched off until the next half-hour period is required. In fair weather the cycle is repeated every half-hour. In foggy weather a hand-operated switch is turned to short-circuit the alternator contacts and the whole signal, consisting of the one-minute transmission and three minutes silence, is then repeated continuously.

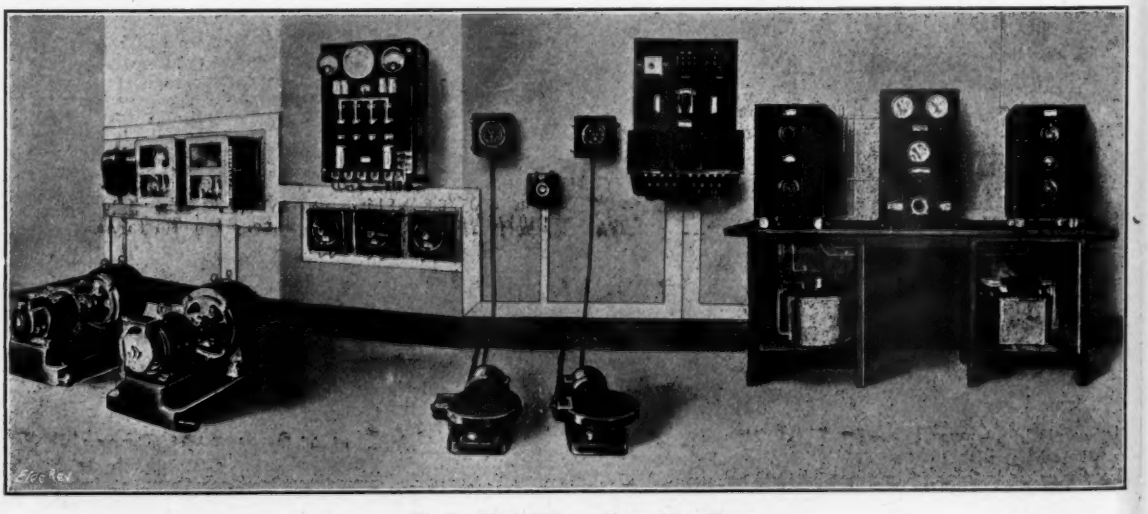


Fig. 2.—Wireless Beacon Transmitting Plant.

In addition to the clock switchboard mentioned above, switchboards are provided for the main power plant, on which are mounted all the necessary instruments, switches, &c., for controlling the respective running machinery. The motor alternators consist of a shunt-wound 1¼-kW d.c. motor designed for a 50-volt input supply, coupled to a separately-excited 100/150-volt, 400/600-cycle, single-phase alternator, both mounted on a cast-iron bedplate. Suitable field regula-

tors and automatic starters are also provided, and the frequency of the alternating current can be varied within the limits of 400 and 600 cycles.

The glass-cell battery is of ample capacity to run the complete station for a period of 12 hours without re-charging. Special gear has been installed which automatically starts up the engine and proceeds with the charging of the battery, directly the battery discharges itself below a predetermined level; immediately the voltage of the battery has reached the required level, the engine is automatically switched off.

A feature of the charging plant is that the line voltage is kept constant and the automatic control switchboards are so arranged that at every charge the engines are used alternatively. If one engine fails to start when required, the battery, after a few seconds, will be automatically switched to the other engine. Should this fail to start, the plant will switch itself off altogether, and ring a bell to warn the lightkeeper. The power of the station, assuming a normal ship's d.f. receiver, is capable of giving accurate bearings up to a range of from 70 to 100 miles.

The National Radio Exhibition.—II.

Some impressions of the show: a review of the trend of development in the design of modern apparatus, and features of the new exhibits.

LONDON ELECTRIC STORES, LTD.—On this company's stand a simple radio control clock was to be seen, fig. 6; it will not only switch a radio set on and off at any predetermined time automatically, but also function as an ordinary alarm clock.

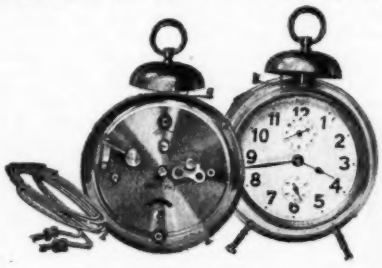


Fig. 6.—A Radio Control Clock.

METRO-VICK SUPPLIES, LTD., was showing a 5-valve set, fig. 7, which can be operated with the usual batteries or for use with either a.c. mains, 40 periods and upwards, or d.c. mains, requiring neither accumulator, anode, or grid-bias batteries. The aerial circuit is arranged with four degrees of selectivity by the insertion of a telephone plug into one of four sockets; tuned inter-h.f. coupling is used, and couplings are tapped with inverse feed back around the valve for balancing or neutrodyning. Capacity reaction around the detector valve facilitates search by carrier waves, at the same time reducing interference due to radiation. Low-frequency amplification is resistance-coupled, and the change from one band of wavelengths to another is effected by replacing three air-spaced coils, while a switch enables the last three valves only to be used for reception of near-by stations.

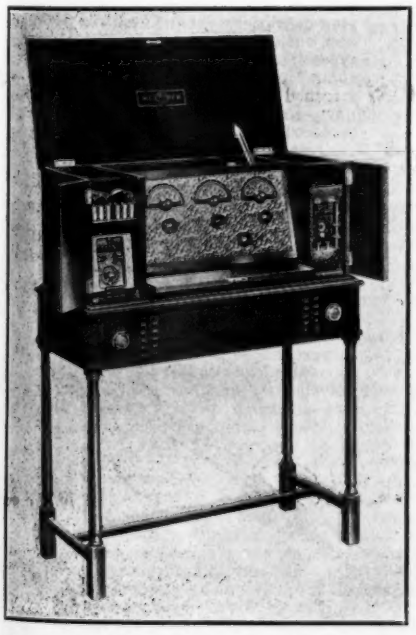


Fig. 7.—Metro-Vick 5-valve Receiver with Battery Eliminators.

"Shortpath" a.c. valves enable users to operate their sets entirely from the electric light mains. They have a special 5-pin cap, and a disk adaptor is provided so that the valves can be used in a set wired for accumulator valves without any alteration to the wiring, or used direct with an a.c. valve holder.

The latest additions to the range of "Cosmos" components are astatic non-parasitic tuning coils wound so that their stray magnetic field is extremely small; there is therefore no necessity for metal screening. The coils are both "centre tapped" and "quarter tapped," and a few turns of insulated resistance wire on each half, fig. 8, are so arranged that the parasitic oscillations in each half coil set up voltages on these turns and damp themselves out, while the fundamental oscillations throughout the whole coil are unaffected by these turns, which are balanced against one another.

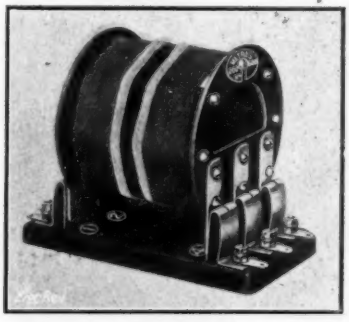
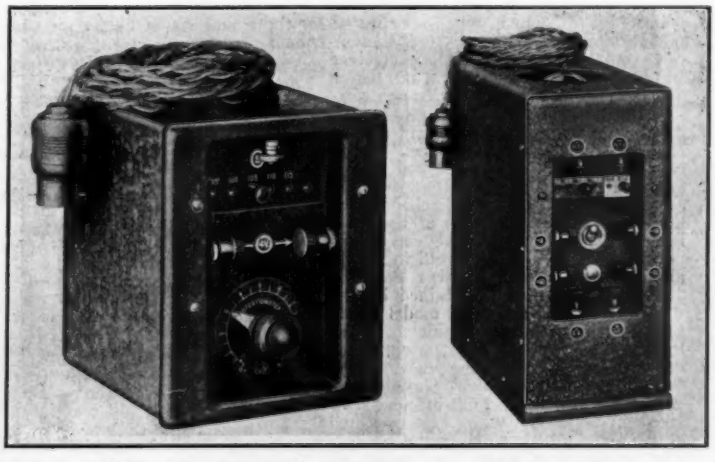


Fig. 8.—"Cosmos" Astatic Non-parasitic Coil.



Figs. 9 and 10.—"Cosmos" Filament and Anode Battery Eliminators.

EDISON SWAN ELECTRIC CO., LTD.—This Company is responsible for the appearance of the first "multi" valve in this country, and it will shortly market a receiver of most interesting design: the set is only approximately 7 in. square, and both the circuit and single valve employed are departures from regular practice, as fig. 11 indicates. The new valve is known as the ES.220 "Duplex," and is specially constructed

to function as a detector and amplifier; it possesses one filament only (thus the 2-volt current consumption is low), but two grids and two anodes, the base having six pins. The current demand from the anode batteries is surprisingly small, being, it is claimed, about one-third of that ordinarily necessary for equivalent loud-speaker results; moreover, the set does not re-radiate. The new model (fig. 12) of the Ediswan r.c. "Threesome" is of equal reception quality to the original one, but its construction has been simplified, the wiring having been reduced from 24 connections to five, and no soldering is

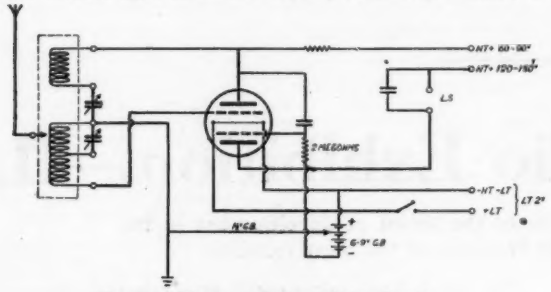
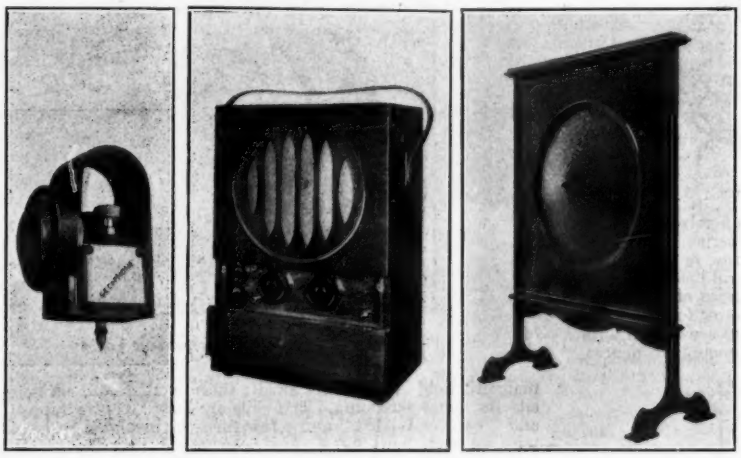


Fig. 11.—Ediswan "Duplex" Valve Circuit.

required. Like the original, the new receiver is essentially a local station set, but since reaction and leaky-grid rectification have been incorporated its range has been extended.

The General Electric Co., Ltd., exhibited a number of new receivers, loud-speakers, and components; although sensitivity and selectivity have not been neglected, tonal quality and



Figs. 13, 14 and 15.—G.E.C. Gramophone Pick-up, Portable Receiver, and "Screen" Loud Speaker.

natural reproduction have been placed first and the most noteworthy feature is the means by which each set may be used as an amplifier for the new "Gecophone" gramophone pick-up device (fig. 13), which, when substituted for the sound-box of *any* gramophone, will give reproduction from records *via* the valve amplifier of the wireless receiver and loud-speaker as good as, if not better than, an expensive gramophone; particularly is this so when the records are themselves recorded by electrical means. Each of the new "Gecophone" radio receivers and gramophone reproducers is provided with a jack on the panel for accommodating the plug attached to the leads of the pick-up. Two of the new receivers (a 4- and 6-valve set) incorporate principles of neutralising, and alternative reception of either the local station or Daventry is obtained by the three-valve "L. and D." model solely by the operation of a single switch mounted in the centre of the panel, no other tuning device being visible. The "Gecophone" five-valve portable receiver (fig. 14) has a built-in cone loud-speaker, together with batteries and frame aerial all contained in the cabinet, and provision is made for using an external aerial and earth and an external loud-speaker, if desired.

R. I. Varley, Ltd., showed 5-valve receivers designed to secure stability and selectiveness on a novel principle; that is, by the incorporation of a new type of Mullard-R. I. Varley "Interdyne" valve which is provided with a double grid and two separate anodes, but only one filament, so disposed that it affects only one of the anodes. Figs. 16 and 17 indicate the mechanical construction of the valve, which is Dr. J. Robinson's patent, and is intended to neutralise electrode capacity inside the glass bulb and thus enable the external devices hitherto used for compensation to be dispensed with. The external appearance of the valve is normal: there are the usual four pins at the base, but a flexible lead is provided on the side of the base for connection to the second plate.

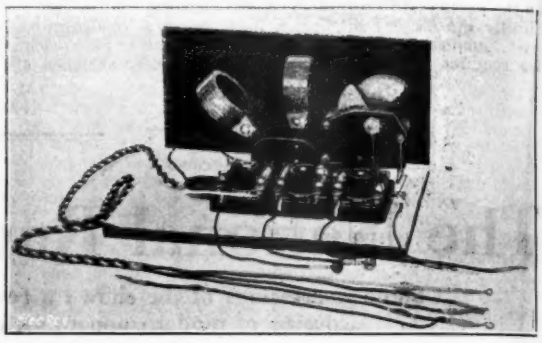
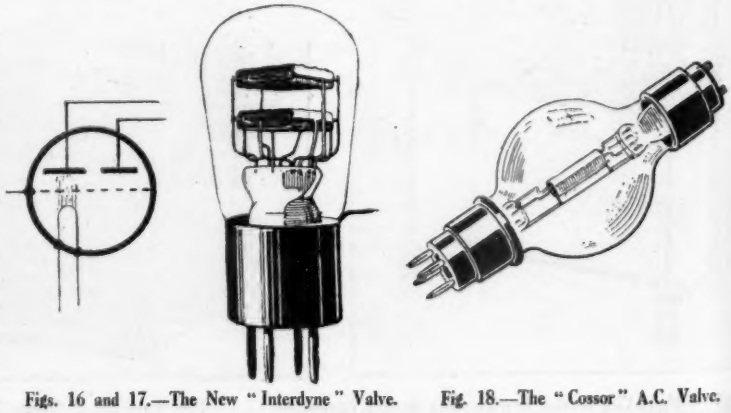


Fig. 12.—New Ediswan "Threesome" Receiver.

A. C. Cossor, Ltd.—This firm's screened-grid valves are made up of a cylindrical glass bulb with moulded caps at each end provided respectively with three and two contact pins. It is arranged that the getter enters into the screening scheme by being present on the inside of the bulb to a point half-way along the valve. It is understood that two types will be marketed, one for 2 volts, consuming 0.1 ampere, and the other for 6 volts, with a consumption of 0.25 ampere. Somewhat of the same appearance as the former are a.c. valves; they are provided with two moulded end-caps, but with a spherical glass bulb (fig. 18) and indirectly-heated cathodes for operation off the domestic electricity mains, the voltage being suitably reduced by a transformer which the Cossor Co. supplies. One end cap carries four pins disposed in the usual positions, the other cap two terminals for the connections for the heater element; thus a special holder is not required. Four types are sold: for h.f., detector or first l.f., resistance coupling, and power amplification purposes.

The London Electric Wire Co. and Smiths, Ltd., exhibited many new patterns of coil, including a centre-tapped plug-in variety wound with Litz wire and enclosed in a moulded case; ten types form the range of fieldless "binocular" coils, whilst a development of screened coils is shown in fig. 19. This new component consists of three screened coils arranged in gang formation and will tune both Daventry and B.B.C. ranges without changing coils.

The Electron Co., Ltd., exhibited a range of "Six-Sixty" valves which have a filament that, in addition to being entirely glowless, is nearly four times the length of that used in the



Figs. 16 and 17.—The New "Interdyne" Valve. Fig. 18.—The "Cossor" A.C. Valve.

earlier design, and has a corresponding increase in electronic emission. Duo-triangular filament suspension, the filament being rigidly supported at five points, *i.e.*, at each quarter of its effective length, is intended to reduce vibration, but (besides the usual 2-, 4-, and 6-volt 0.25-, 0.1-, and 0.075-ampere types) a novel pattern has been evolved that is claimed to eliminate microphonic noise. The valve proper is mounted resiliently inside an outer bulb, and the air contained between the two

glass envelopes is removed; the vacuum thus created prevents any external interference from reaching the valve itself, which is known as type T.

Artandia, Ltd., has designed a series of speakers that are intended to appeal to lovers of the artistic. The instruments are made of porcelain or papier maché in replica of birds, legendary figures, &c., fig. 20 showing one of the many unique models available. The figures are hollow and stand on a raised plinth in the base of which is the exit for the sound waves; a vertical magnetic reproducer carries a short horn, which is

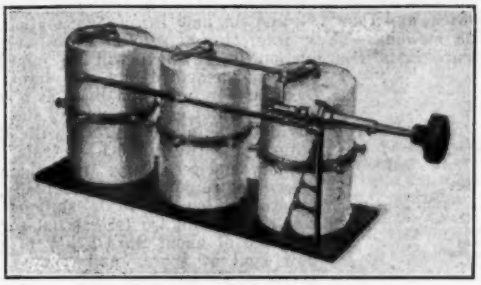


Fig. 19.—"Lewcos" Dual Screened Coil.

extended up into the hollow figure wherein is an air-spaced cavity which is claimed to possess good acoustic qualities. Surmounting the more expensive modes is an electric lamp under a silk shade.

The "Andia" loud-speaker is non-directional owing, it is claimed, to the principle of placing the end of its non-metallic sound tube at the focal point of a parabolic sound reflector, with the result that the intensified sound emerges and travels equally strongly in all directions in natural spherical waves. There is no rim which is free to vibrate, because the edge of the inner parabolic shell is joined to, and is continuous with, that of the outer shell, making an "endless" whole and so reducing the possibility of sound distortion.

Fig. 20.—"Andia" Loud-speaker and Shaded Lamp.

London and Home Counties Electricity District.

Annual Report of the Joint Electricity Authority.

THE report of the London and Home Counties Joint Electricity Authority for the year ended March 31st, 1927, was issued last week.

During the year Sir George Hume, M.P., and Ald. R. Moritz, K.C., resigned their membership; Mr. F. B. Galer, M.A., and Coun. H. J. Nias, M.B.E., filled the vacancies. Mr. S. J. Watson, M.Inst.C.E., was appointed chief engineer to the Authority.

The Authority promoted a Bill to sanction the erection of a generating station at Duke's Meadows, Chiswick, which was ruled non-compliant with the Standing Orders, and by leave a revised Bill was deposited embodying the necessary provisions.

The administrative expenses of the Authority for the year 1927-28 were estimated at £17,065 (including a deficit of £535 from the previous year), of which sum £16,215 has been apportioned amongst authorised undertakers in the District; the County Councils and the Railway Companies' Association have been asked to contribute the remainder, *i.e.*, £850. The London County Council agreed to guarantee the interest on a sum of £1,000,000 to be borrowed by the Authority for the purpose of its technical scheme.

The London companies submitted statements of the value of their physical assets, which, as summarised in an appendix, amounted as finally agreed to £13,136,157 (excluding the Charing Cross Electricity Supply Co., whose statements were not complete). "It is understood that considerable progress has been made between the County Council and the companies with regard to the figures to be adopted for the settling of the standard prices which are to operate as from the 1st January, 1926." Sinking funds have to be provided by the companies to liquidate the value of their physical assets and other capital expenditure; the periods which the Electricity Commissioners have approved for the purposes of these sinking funds are set forth in the Report.

It was not possible to complete the detailed report upon the main outlines of the technical scheme for the district within the time prescribed in the Electricity District Order, 1925; an interim report was submitted to the Commissioners, and the detailed report was forwarded on October 28th, 1926. The Commissioners, on December 14th, commented on the proposals contained in the report, pointing out that it mainly related to the development of the western portion of the district by the establishment of a new generating station at Chiswick and a new transmission system radiating therefrom; it did not formulate proposals showing how co-ordinated development in the various parts of the district might best be effected in the interests of the district as a whole. Any proposals for development must fit in with the scheme which the Commissioners would prepare for submission to the Central Electricity Board. [The scheme referred to is outlined on pp. 604 and 605.]

On the invitation of the Commissioners, efforts were made to appoint a small technical advisory committee to prepare a more comprehensive scheme, but some of the engineers nominated were unable to accept the Authority's invitation, and eventually the Commissioners, in view of the difficulties which had arisen, withdrew the proposal.

Particulars are given of the proceedings taken with regard to the proposed erection of a new generating station at Chiswick, to have an ultimate capacity of 325,000 kW. On November 24th, 1926, Messrs. Preece, Cardew & Rider were appointed consulting engineers in connection with the first section of the station.

Particulars of extensions of generating stations and main transmission lines are set forth in tabular form; all proposals for extensions of mains were approved, but in many cases bulk supply was recommended in preference to an increase of generating plant. The Brompton and Kensington Electricity Supply Co., Ltd., was authorised to change its supply frequency from 83 to 50 cycles/sec., and the Notting Hill Electric Lighting Co., Ltd., to establish 3-phase, 4-wire supply at 230-400 volts, 50 cycles, throughout its area; West Ham Council was authorised to alter the supply pressure from 200 and 100 volts to 200 volts. The Authority entered into negotiations for many bulk supplies to be given to authorised undertakers. Seven applications for Special Orders to supply electricity in areas within the district were considered, and in some cases were the subject of protracted negotiations in view of the Authority's obligation to submit, by July 25th, 1927, proposals to supply electricity in areas not covered by existing statutory powers; the only areas not yet dealt with are the parish of Crowhurst and parts of Bletchingley, Godstone, and Tandridge, and the parish of Gatton, in which areas there is at present no demand for a supply.

The accounts of the Authority for the year show a total expenditure of £11,887, exceeding the income by £2,262; as a balance of £1,611 was brought forward from the previous year, the actual deficit was £651.

The S.E. England Electricity Scheme, 1927.

Prepared by the Electricity Commission in pursuance of Section 4 of the Electricity (Supply) Act, 1926, and published by the Central Electricity Board.

PREPARED by the Electricity Commission and "transmitted" by it to the Central Electricity Board, the above-named scheme deals with an area of about 8,828 square miles, covering the counties of London, Middlesex, Hertford, Essex, Kent, Surrey, Berkshire, Bucks., Bedfordshire, Cambridgeshire, Huntingdonshire, and parts of the counties of Sussex, Hampshire, and Suffolk. It stretches from Wisbech and Peterborough on the north to the south coast, as is shown in fig. 1, and has a population of 11,392,561.

Fig. 1.—The South-East England Electricity District.

At present there are 165 authorised undertakers in the area, including the London and Home Counties Joint Electricity Authority and eight power companies, owning, between them, 135 stations. The present consumption of electricity is about 112 kWh per head of population, which figure is estimated to increase to an average of 265 kWh in 1933-34 and 426 kWh in 1940-41. Thirteen existing stations and the two new stations projected at Battersea and Chiswick will be selected and operated for the Central Electricity Board; a list of the stations will be found in Table I. A further fifteen existing stations will come into the scheme under temporary arrangements for varying periods, and it is contemplated that three of the selected stations will be extended between 1931 and 1938 (see Tables II and III), and that three additional stations will be erected before 1940, one in the northern part of the area, another probably in the neighbourhood of London, and the third on a site not yet determined. Broadly, the scheme looks forward to the area being supplied, ultimately, by eighteen capital stations, *i.e.*, thirteen existing, the two already projected, and three new. It is probable that the stations bearing the main load for the area will be the riverside stations at Battersea, Barking, Chiswick, and Deptford, and the new Brimsdown station.

The stations will be interconnected by a series of high-pressure main transmission lines which will be joined to, and supplemented by, a series of secondary transmission lines at a lower voltage, suitable for supplying the various undertakings concerned with distribution; the transmission systems, both primary and secondary, are designed in a series of ring-mains. Incidentally, the interconnection of these stations will result in the release for revenue-earning purposes of about 245,175 kW of plant now kept as spare, and representing about £3,700,000 of capital.

The principal main transmission lines to be constructed by the Central Electricity Board for the interconnection of selected stations with one another and with the systems of authorised distributors will number 16, and are delineated on the accompanying maps (figs. 1 and 2). They will be 3-phase overhead lines operating at 132,000 volts between phases and capable in each case of transmitting 50,000 kW; the first will be completed by October, 1929, and the last by October, 1932. In connection with them transforming stations are to be provided at 24 places, varying in capacity from 20,000 to 225,000 kVA.

Secondary main transmission lines to be constructed by the Board, or (by arrangement) by authorised undertakers, number (*a*) 16 three-phase overhead lines operating at 33,000 volts, and (*b*) 20 three-phase underground lines to operate at 22,000, 33,000, 66,000, or 132,000 volts between phases. They will interconnect the Board's system with those of authorised undertakers, and in connection with them transforming stations will be provided at 47 places, varying in capacity from 600 to 120,000 kVA.

Provision will, of course, be made for connecting the Board's system in the South-East area, as and when necessary, with its systems in adjacent areas, the several regional schemes thus ultimately merging into one national scheme for the whole of England, Wales, and Scotland.

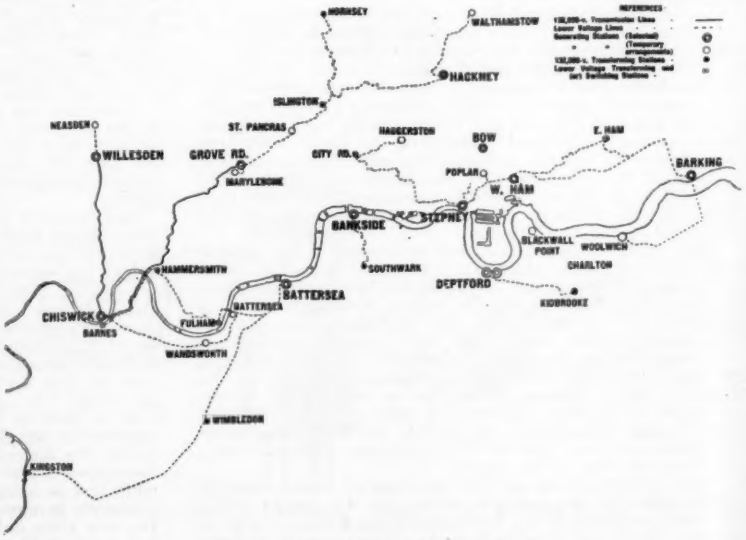


Fig. 2.—The London Area of the District.

During the carrying out of the work specified in the scheme the owners of each of 43 generating stations within the area will be under the obligation (temporarily) of the Central Electricity Board, as and when directed by it, (*a*) to work

the station so as to generate such a quantity of electricity at such rates of output and at such times as the Board may direct, and (*b*) to supply to the Board all electricity so generated and not required by such owners for the purposes of their own undertaking. So long as any station is being operated in accordance with directions given by the Board in pursuance of section (*a*) the Board shall be under the obligation to supply either directly or indirectly to the owners thereof such an amount of electricity (if any) as the owners may require for the purposes of their undertaking, in addition to the electricity which they are for the time being generating at that station for those purposes. Unless otherwise agreed the Board will pay to the owners of the station for the electricity supplied to the Board under section (*b*) the additional costs which the owners actually incur in generating at the station more electricity than is used for the purposes of their undertaking, including an allowance for additional depreciation (if any), attributable to the generation of such electricity. Unless otherwise agreed, the owners of the station will pay for the electricity supplied to them as above the difference between the costs which the owners actually incur in generating at the station electricity used for the purposes of their undertaking, and the cost which they would have incurred in generating at the station both the last-mentioned electricity and the electricity supplied to them as above.

The Commissioners have issued with the scheme a series of supplementary particulars, in which they have outlined a plan of working the selected stations, with the necessary estimates; the suggestions are, of course, tentative, since the practical working of the scheme, including the fixing of tariffs, is the responsibility of the Board; but, taking the figures as they stand, it is of interest to note that the Commissioners contemplate that the Board should be able to commence supplying in August, 1928, and estimate that in the five years 1929 to 1934 there will be a resultant saving to the undertakers in the area of nearly £5,000,000, or an average of about £1,000,000 per annum, which saving should increase with the lapse of time. There must be added a further saving due to the cessation of the capital charges on existing generating plant in stations which will be shut down; this extra saving will accrue as and when the capital cost of the discarded plant is redeemed, and an indication of its extent is afforded by the fact that the capital charges on plant in the stations which are expected to be shut down by 1933-34 amounts to £480,000 per annum.

The cost of the scheme to the Board for the erection of the primary transmission system is estimated at about £6,500,000; in addition, there will be an expenditure of about £5,500,000 by the owners of generating stations on extensions, &c. It is estimated that the full advantages of the scheme can be secured with a saving of about £500,000 on capital expenditure (up to the year 1933-34), as compared with the expenditure which would be necessary if the present system were continued; after that date the saving on capital expenditure should be progressively greater, as compared with individual development.

With regard to the portion of the area consisting of the district of the London and Home Counties Joint Electricity Authority, the scheme proposes that the Joint Authority should be responsible in its district for laying certain of the secondary transmission cables and sub-stations which will be necessary for supplying the authorised undertakers in the Joint Authority's area; the cost of these lines to the Joint Authority is estimated at about £2,000,000. The Joint Authority will receive its electricity from the Board and will transmit it along these lines to the undertakings in its area, making the necessary charges to cover the expenses of the lines; the effect of this upon the undertakings concerned appears to be that the total cost to the undertakers of the indirect supply through the Joint Authority will be less than the cost of individual development by about £212,000 per annum (1933-34). There will be a further saving to some of these undertakers as and when the capital charges on their existing generating plant are paid off. Such charges in the case of stations which are expected to be shut down by 1933-34 amount to about £156,000 per annum, and are included in the previously-mentioned figure of £480,000.

Copies of the scheme and supplementary particulars may be purchased for 2s. and 4s., respectively, from H.M. Stationery Office. Authorised undertakers and others may make representations thereon by registered letter addressed to the Board not later than November 15th, 1927.

TABLE I.

Existing Selected Stations.

Bankside (City of London Electric Lighting Co., Ltd.).
Barking (County of London Electric Supply Co., Ltd.).
Bow (London Power Co., Ltd.).
Brighton (Corporation).
Brimsdown (new) (North Metropolitan Power Station Co., Ltd.).
Deptford East (London Power Co., Ltd.).
Deptford West (London Power Co., Ltd.).
Grove Road (London Power Co., Ltd.).
Hackney (Borough Council).
Peterborough (Corporation).
Stepney (Borough Council).
West Ham (Corporation).
Willesden (London Power Co., Ltd.).

TABLE II.

Extensions and Alterations of existing Selected Stations.

(i) Brighton, addition of 20,000 kW of 3-phase 50-cycle plant for operation by the winter of 1937-38.

(ii) Hackney, addition of 20,000 kW of 3-phase 50-cycle plant for operation by the winter of 1933-34; a further addition of 20,000 kW of 3-phase 50-cycle plant for operation by the winter of 1934-35.

(iii) Stepney, addition of 20,000 kW of 3-phase 50-cycle plant for operation by the winter of 1933-34; further addition of 30,000 kW of 3-phase 50-cycle plant for operation by the winter of 1937-38.

TABLE III.

New Selected Stations.

(i) Battersea (London Power Co., Ltd.)—the first section to comprise 120,000 kW of 3-phase 50-cycle plant ultimately to be extended to a total of 360,000 kW (the first section will be required for operation by the winter of 1932-33).

(ii) Duke's Meadow, Chiswick (London and Home Counties' Joint Electricity Authority)—the first section to comprise 120,000 kW of 3-phase 50-cycle plant and ultimately 360,000 kW (the first section will be required for operation by the winter of 1934-35).

(iii) Little Barford, near St. Neots (Bedfordshire, Cambridgeshire, and Huntingdonshire Electricity Co.)—the first section to comprise 25,000 kW of 3-phase 50-cycle plant (date required for operation uncertain).

(iv) Station A (in east of area)—the first section to comprise 200,000 kW of 3-phase 50-cycle plant (the first section will be required for operation by the winter of 1938-39).

(v) Station B—the first section to comprise 200,000 kW of 3-phase 50-cycle plant (the first section will be required for operation by the winter of 1940-41).

Legal.

Wireless Merchant Summoned.

At Old Street Police Court, last week, Thomas Kelly, 17, Norton Folgate, was summoned for receiving certain wireless accessories, knowing them to have been obtained under circumstances which amounted to misdemeanour.

Mr. F. J. Powell, in opening the case, said that the prosecution was at the instance of the Commissioner of Police. Defendant was a wireless accessories merchant, and although only one date was mentioned in the summons, he (counsel) proposed to call evidence of seven or eight other occasions on which defendant received property under similar circumstances from the same person. The suggestion was that he had been doing it on a very large scale. A person named Forrest T. Williams, who pleaded guilty at that Court to obtaining wireless goods from many different firms by false pretences, made a statement before he was dealt with. The case for the prosecution was that in January of this year Williams called upon defendant for employment, and Kelly suggested that he should provide Williams with a small sum of money to open an account at the bank, and that Williams should then go to different firms and get goods. The summons related to goods obtained from the Celestion Company.

Forrest Trevor Williams said he was now serving a sentence of three months passed at that Court for obtaining goods by false pretences. In January he was in want of employment and went to defendant, who made him a loan of £20 and suggested that he should start in business in some way. He paid the £20 into the bank, afterwards ordering goods from the Ormond Engineering Co. and giving a cheque for £30 8s. That cheque was dishonoured. County Court proceedings were afterwards taken, and he paid nothing. He handed the goods in at Kelly's shop. The case was adjourned, defendant being admitted to bail in two sureties of £100 each.

Radio Research in Australia.

The Radio Research Board constituted by the Federal Council for Scientific and Industrial Research has mapped out its programme for the ensuing year, says the *Industrial Australian and Mining Standard*. It will work in close co-operation with the corresponding body in Britain. Its members are Dr. J. P. Madsen (chairman), professor of electrical engineering at the University of Sydney; Mr. H. P. Brown, director of postal services; Dr. T. H. Laby, professor of physics in the University of Melbourne; and Commander Cresswell, of the Defence Department. Prof. Madsen left Australia in August on a private visit to England, and while here he will inquire about the work of the British Board, and arrange for collaboration. When necessary, the cost of apparatus will be borne by the Council of Scientific and Industrial Research, on which will rest the ultimate responsibility for the scheme.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

Bird-Shield Material.

We have received from the Greenwich Cable Works, Ltd., Grooms Hill, Greenwich, London, S.E.10, a sample piece of "Pernax," a material which the firm is supplying in the form of bird guards for the protection of overhead-line equipment for up to 30,000 V. Designs to fit practically any type of insulator, crossarm or staywire can be supplied. The following qualities are claimed for the material: high insulation value, waterproofness, non-perishability, flexibility, and permanent surface insulation. It is a tough but flexible material, and appears to be similar to that used for the insulation of the cables of the same name.

Shop-Window Lighting Fittings.

A recent introduction of Messrs. L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, Kingsway, London, W.C.2, is the "Frink Silverlite" reflector, fig. 1, for shop-window lighting. It is claimed to be suitable for every type of window. The actual reflecting shell is constructed of solid silver, strengthened by copper electrolytically deposited on the outside of the silver shell. It is unbreakable, will not chip, peel, or tarnish, and is fully guaranteed. An interesting feature is the adjustable focusing neck which, without tools or fitments of any kind, enables the lamp filament to be correctly focussed, thus ensuring maximum efficiency with minimum costs. Recently an extensive showroom was opened in London by

Fig. 1.—"Frink Silverlite" Reflector.

Messrs. Hawkins, for displaying their very large selection of interior scientific shop-lighting units. We understand that a special service has been inaugurated for advising on efficient and correct illumination.

A Flush-Switch Plate.

An addition to the range of bakelite products of the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, is a range of flush-switch plates, which are made to accommodate one, two, three, or four switches each. These are particularly attractive in design, and, it is claimed, they will not corrode or tarnish, but will retain their fresh appearance permanently. In addition, there is a pattern which will accommodate a switch and plug. Three finishes are provided, natural brown, black and oak. Provision is made to prevent the one-way plate from becoming twisted after fixing.

A New Electric Wash-boiler.

A recent addition to the "Gee-Gee" products of Messrs. George Green & Co., 40, Aybrook Street, London, W.1, is the "Theta" electric wash boiler, fig. 2, which, it is claimed, is built to withstand the roughest of usage, being made of the highest grade materials. The interior pan and the flat "table-top" lid are built of stout-gauge copper, tinned inside, and the steel outer casing, legs, and cast-iron top frame are heavily galvanised after manufacture. A small sump accommodates a "Gee-Gee" immersion heater, which is protected by a removable perforated cover. The boiler is supplied complete with a tinned-copper spraying device, which forces a continuous supply of soapy boiling through the clothes, so, it is claimed, effectually loosening and removing the dirt. A brass tap with an insulated handle is provided to empty the boiler, and a sump draining cock is supplied if required. The air between the two cases forms an effective lagging, but the model may also be supplied lagged with special heating insulating material. Although primarily intended for a wash boiler, when the sprayer is removed, the apparatus is suitable for several other purposes, *i.e.*, boiling water, cooking ham, vegetables, and so on. The boiler has a capacity of 10 gallons,

Fig. 2.—The "Theta" Wash Boiler.

and its loading is 3 kW. Its dimensions are 26 in. high and 20 in. diameter.

A Car-Dynamo Test Bench.

We have received from Messrs. Fredk. J. Gordon & Co., Ltd., 92, Charlotte Street, London, W.1, British distributors for Hobart Brothers Co., United States, some particulars of the latest Hobart introduction, a test bench for car-lighting dynamos, starters, magnetos, and so on. It is equipped with a 1½-h.p. reversible, variable-speed motor fitted with a self-aligning coupling and an adjustable flexible mounted chuck. A vice is conveniently placed to hold in position for test various sizes of apparatus. A feature of the set is the necessary equipment for the complete torque test. Other important accessories for the many tests which can be carried out on the bench are an accurate tachometer, a conveniently located condenser, a calibrated rotary spark gap, an adjustable spark gap, specially designed test sockets, and a no-glare test lamp. The apparatus is complete with a bakelite switchboard equipped

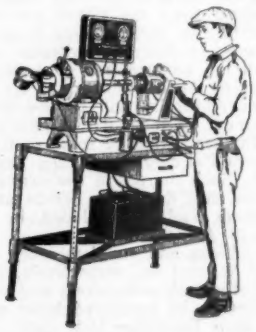


Fig. 3.—Automobile Generator Test Bench.

with accurate instruments built to the makers' specification. The test bench, fig. 3, is claimed to be particularly suitable for dynamo output, torque and speed tests, and also magneto-firing tests at all speeds.

The "Utility" Fixed-Charge Collector.

Referring to the description of the "Fixed-Charge Collector" in our last issue, we are informed that the last paragraph is not strictly correct.

The collector does not "close" the circuit until the consumer has inserted the requisite number of coins, but if a consumer has done this he can insert further coins as he may have them available, and when the apparatus is made to open the circuit, the consumer need only add a few more coins in order to remake the circuit.

High-Frequency Induction Melting.

By D. F. CAMPBELL, M.A., Assoc. R.S.M., F.G.S. (London).

(Abstract of paper read at the Autumn Meeting of the IRON AND STEEL INSTITUTE.)

LOW-FREQUENCY induction furnaces have serious limitations; the molten metal is contained in a hearth of complicated form with a large area of refractory material exposed to the steel, which involves high maintenance cost and lack of homogeneity in the steel, while the slag is only melted with difficulty, so that efficient refining is impossible. It is also necessary to leave, or place, a quantity of steel in the furnace after each heat to form the secondary connection, which is a serious difficulty when making alloy steels, as the weight of steel cannot be determined with sufficient accuracy to work to close specifications. In the case of high-frequency induction furnaces the crucible can be completely emptied after each heat.

A characteristic form of the ordinary low- or standard-frequency furnace is shown in fig. 1, which illustrates the complicated form of bath, while fig. 2 indicates the bath of a high-frequency furnace. In the former case it is necessary that the bath of molten metal should be annular in form, so that it may surround and form the secondary of one or more iron transformer cores, but in the case of high-frequency furnaces, ironless induction is used and heat is generated by eddy currents, so that a cylindrical or spherical bath can be used—the ideal form of metal container for metal melting—and no iron core is required.

Fig. 1.—Rodenhäuser Low-frequency Furnace.

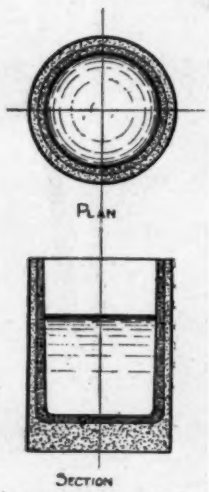


Fig. 2.—Northrup High-frequency Furnace.

The use of high-frequency electricity for melting metals in the laboratory has been generally recognised as one of the most important advances of recent years, owing to the new physical conditions under which metals can be melted or heated. This method is now available for the industrial production of steel, and is applicable to the melting of tool steel and the manufacture of small steel castings, especially those that are required to replace small malleable iron parts which lack the reliability that is demanded by modern engineering practice.

Low- or normal-frequency induction furnaces are electric transformers, in which a ring of metal to be melted surrounds a laminated iron core, round which primary coils are wound. With high-frequency currents the iron core is not necessary, and the furnace bath may be constructed in a cylindrical form, similar to that of an ordinary crucible, which is ideal for low heat losses and good metallurgical conditions for the maintenance of refractory linings. A low power factor is characteristic of this design, but this is easily corrected to any desired extent by the use, in the case of the Ajax-Northrup furnace, of condensers at a reasonable cost and efficiency.

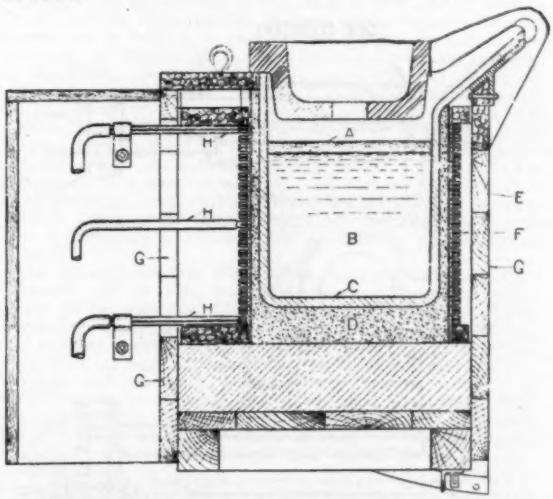
Ironless induction at normal frequency for small-sized furnaces, such as those required for tool steel manufacture, involves an expenditure on electrical machinery for power-factor improvement which is prohibitive, both as regards first cost and power consumption, as compared with the Northrup system of high-frequency generators, driven by motors, with condensers. With this equipment the furnace installation is simple, as it only consists of a motor-generator, a bank of condensers to improve the power factor of the furnace circuit to any required degree, and a tilting furnace of simple but unusual design. Suitable control instruments, regulator, and switches complete the electrical plant.

The furnace itself is of remarkably simple construction, consisting of a crucible or metal container, surrounded by about one inch of heat-insulating sand; around this a helical coil is wound, which is usually maintained at a low temperature by circulating water. This coil is the inductor carrying the water and high-frequency current, and the heat is generated within the metal itself inside the crucible, so that the walls merely serve the purpose of a container, and no heat is passed from the outside of the crucible to the metal within. This has an important bearing on the crucible consumption, which is only a fraction of that in an ordinary furnace where heat is driven through the crucible, and wear and tear occurs on the outside and the external temperature is necessarily higher than that of the metal. No mechanical strength is required, as the crucible is always well supported by the packing of sand, and it is not withdrawn for casting.

The inductor coil is built into the furnace body, which is made of wood or other material in which heat will not be produced by induction. The body, which is easily replaceable, is generally fixed in a cradle arranged for nose-tilting by electric motor, so that there is little or no movement of the crucible spout during teeming operations.

The metallurgical characteristics of the furnace are interesting, and some operations that were impossible in the past, such as the remelting of stainless iron without absorption of carbon or sulphur, can now be accomplished.

Heating and melting are effected very rapidly, as induction heating makes it possible to generate heat throughout the charge of metal simultaneously, instead of heating from the surface only, as is the case with all fuel furnaces. For melting operations and the heating of bars this is sometimes advantageous, as the risk of oxidation and contamination from furnace gases is reduced, and for making small castings the frequent melting of small quantities facilitates economy in general foundry practice. As an example of speed, it is possible to melt 18 per cent. tungsten steel in 3-cwt. lots in forty-five minutes, which is less than one-quarter of the time normally required to melt one-third of this charge in a crucible in a coke fire.



A. Molten Slag; B. Molten metal; C. Crucible; D. Insulating packing; E. Insulating sleeve; F. Induc or Coil; G. Furnace body; H. Electrical and water conduits.

Fig. 3.—Cross-Section of Ajax-Northrup High-frequency Furnace.

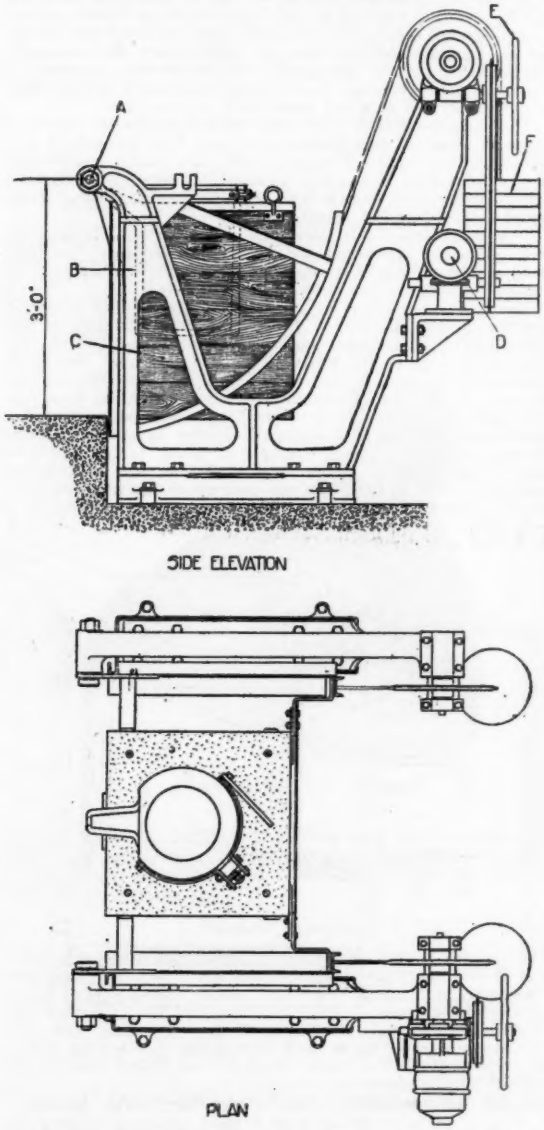
The following record shows a typical day's work with a small unit of only 100 kVA, pouring 3 cwt. of high-grade nickel-iron alloys from a siliceous crucible entirely free from carbon. The carbon in the alloy was in every case below 0.04 per cent.

Heat No.	Date.	Time.	Total Time.	Charge. Lb.
62	1/2/27	9.20-10.50 A.M.	1 hr. 30 min.	336
63	,,	10.55-12.00 ,,	1 ,, 05 ,,	336
64	,,	12.02- 1.12 P.M.	1 ,, 10 ,,	336
65	,,	1.15- 2.25 ,,	1 ,, 10 ,,	336
66	,,	2.30- 3.50 ,,	1 ,, 20 ,,	336
67	,,	4.00- 5.15 ,,	1 ,, 15 ,,	336
68	,,	5.20- 6.30 ,,	1 ,, 10 ,,	336
69	,,	6.35- 7.50 ,,	1 ,, 15 ,,	336
70	,,	7.55- 9.00 ,,	1 ,, 05 ,,	336
		Total: 9 heats		3,024
		Total melting time	11 hr. 0 min.	
		Total time, melting and pouring	11 ,, 40 ,,	

The cost of high-frequency furnace melting is about equal to that of small Héroult arc furnaces, as the energy consumption, including all losses, is about the same, and the extra cost of crucibles is approximately equal to that of electrodes. The steel, however, is made under crucible conditions, with the advantage of absolute homogeneity and an intensity of mixing and a melting temperature which is only limited by the refractories and the melter operating the furnace.

The refining and purification of steel in high-frequency furnaces is a question that is receiving much attention. In many cases, tool-steel makers have no desire to refine, but there are cases of interest, notably in connection with heat-resisting steels and alloys, in which absence of carbon is desired.

In high-frequency furnaces the electric current causes a very rapid rotating movement of the metal in the vertical plane, the speed of rotation being so great that in a bath of steel 15 in. in diameter the centre of the bath rises more than 1 in. above the metal at the circumference. This rapid circulation of the metal in contact with the slag quickly refines the metal, the



A. Spout of furnace on the axis of tilting trunnion; B. Crucible; C. Furnace body; D. Tilting motor; E. Hand-wheel for tilting; F. Counter-weights.

Fig. 4.—Plan and Side Elevation of Ajax-Northrup High-frequency Furnace.

heat transference between the metal and slag being sufficient to maintain the latter in a fluid condition, and to ensure that intimate contact which is so essential to rapid and efficient refining. For example, a bath of steel containing 0.7 per cent. of carbon was left in contact with a slag containing oxide of iron for ten minutes and the carbon was then reduced to 0.24 per cent.

The remelting of low-carbon chromium steels without any increase of the carbon content is an industrial application of the utmost importance for the recovery of scrap stainless iron and heat-resisting alloys. The remelting of these alloys without absorption of carbon or impurities from furnace gases has now become a commercial possibility; it should cheapen production and improve the quality of these alloys, which are of such great importance to present-day developments.

The following analysis of a stainless-iron ingot made from carbon-free ferro-chromium and a Swedish iron of exceptional purity indicates that very low-carbon alloys can be made without difficulty:—Chromium, 13.5 per cent.; carbon, 0.03 per cent.

Two applications of high-frequency melting may be described as typical of the most obvious uses for this type of furnace, a photograph of which is shown in fig. 5.

Installations for the manufacture of tool steel usually consist of furnaces, each of 400 to 500 lb. melting capacity and each supplied with 150 kVA from a motor-generator, the power factors of the furnaces being corrected by condensers. The output of such a furnace is about 450 lb. per hour, or about 4 tons per 24 hours, the exact output depending upon the quality of steel made and the number of ingots cast. The furnaces are placed below the working platform so that the top of the furnace is at floor level, which is convenient for charging and for slag removal before casting. The ingots are arranged so that the steel is cast direct from the nose-tilting furnace.

A spare body, consisting of a wooden box with spare coil, crucible, and refractory sand, is provided, and can be put in position in a few minutes when it is necessary to change crucibles.

The diagrams, figs. 3 and 4, show a typical installation in a Sheffield steelworks.

Another typical application is the use of these furnaces in foundries making small castings. For example, a foundry making motor-car castings, where the average weight is between

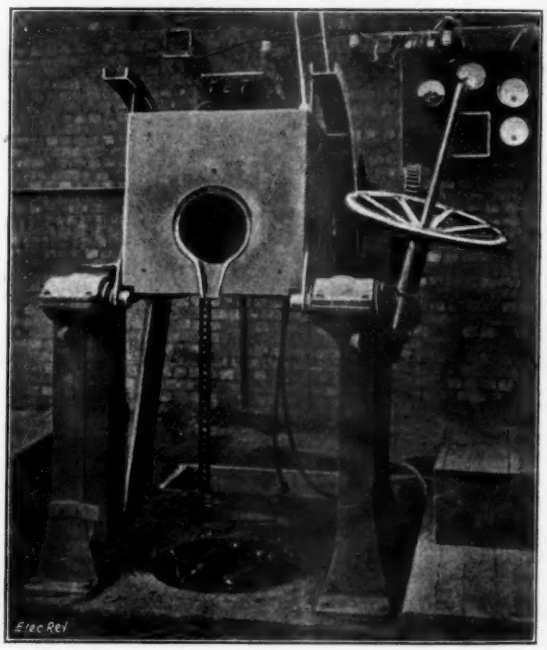


Fig. 5.—High-frequency Furnace in Tilted Position.

2 and 3 lb., can reorganise the system of moulding and general organisation, if small quantities of hot steel are frequently available, and ladles and handshanks can be eliminated. Each motor-generator is arranged to heat two or more furnaces, which are worked alternately, the current being switched from one to the other directly the first is ready for pouring. There is no loss of heat by transfer to ladle or handshank, and the furnace, being well heat-insulated, keeps the steel hot during the casting period.

The high and uniform rate of heating of a mass of steel by high-frequency induction is also being applied to the heating of billets for tube-making, with prospects of success, and by special study it has been found possible to develop useful apparatus for the heating of mining drill steel, and the continuous heating of ¾-in. steel rods at the rate of 60 ft. per minute. The latter apparatus is likely to prove of value for patenting wire and rods, for the heating of bars for nut and bolt making, and for miscellaneous forging operations.

High-frequency generators of 600 kVA are in regular commercial operation, but the ultimate size of high-frequency heating units cannot yet be defined. Generally speaking, there appears to be no technical difficulty in the construction of large generators and the building of furnaces of considerable tonnage, if commercial considerations permit the application of this form of heating.

The scope of high-frequency heating is expanding as rapidly as electrical machinery constructors can meet the requirements imposed upon them, and progress both in melting and heating steel is being rapidly accomplished. Its value is, however, already well established as a method of making crucible steel of remarkable homogeneity at a low cost, with the elimination of the hard physical labour inseparable from present methods.

Discussion.

The PRESIDENT (Mr. F. W. Harbord) remarked that it was most interesting to see the molten steel pouring out of a furnace encased in a wooden box. The temperature outside was so low that there was not the slightest risk of the wooden casing becoming ignited, and yet there was molten steel in the crucible. The heat was, to all intents and purposes, generated in the centre of the mass and there was no question of any impurity getting in.

Prof. C. H. DESCH (Sheffield University), after expressing himself a strong believer in the principle of high-frequency heating, said that he had seen high-frequency induction furnaces working in America very successfully upon nickel alloys. He had had considerable experience of an earlier type of the Ajax-Northrup furnace, which was used at Sheffield University for experimental melts and proved extremely satisfactory. At the University they made their own crucibles, and they did not need to be strong as they were packed in zirconia sand so that a cracked crucible did not cause any mishap. To melt 10 lb. of pure Swedish bar required little more than half an hour, and the loss of heat was extraordinarily small. When it was melted it was possible to take the lid off the crucible with the bare fingers; the lid was then just getting uncomfortably hot. The great achievement of the author was that he had brought the frequency of operation of the furnace down to about 500 cycles, whereas the frequency in the case of previous furnaces of this type had been several thousand. This reduction in frequency did away with troublesome spark gaps and enabled a motor-generator to be used. With high-frequency heating there was no contamination from furnace gases, and as there was no carbonaceous material in the crucibles, it was possible to start with quite pure metals. It was even possible to encase the whole apparatus in a vacuum, so that it should be possible to manufacture steel without slag being introduced.

Mr. CAMPBELL, replying to the discussion, said the temperature to which metal could be taken in this furnace was almost anything; the difficulty was to know what the temperature actually was. It was possible to control the temperature simply by means of a rheostat, and the melter had nothing to look at except this. It was a far simpler job than with an arc furnace. The plant made use of only one moving part, *viz.*, the motor-generator. The condensers were merely tanks of oil containing packets of tissue paper and aluminium foil, and there were a few controlling instruments. This was an equipment which could be put into any works with confidence that it could be maintained in regular operation. It was true that it did not matter if a crucible broke, because the metal was held up by the packing behind the crucible. There was no serious short circuit when the bottom came out of a crucible.

The PRESIDENT asked how long it was possible to maintain the temperature in a charge of 300 or 400 lb. In the ordinary way the metal cooled very rapidly. Mr. CAMPBELL said it was possible to keep that quantity of metal hot for 24 hours without difficulty. The heat insulation was extraordinarily good if zirconia sand were used. Ganister and silica sand were not so good. At the same time, there was no need to maintain the heat, because the current could always be turned on and the heat could be regulated to any desired degree.

The E.D.A. Circle Campaign.

The Scheme Described and Discussed.

THE British Electrical Development Association opened its 1927-28 series of Salesmanship Conferences in London on Friday, September 30th, in the rooms of the Royal Society of Arts, John Street, Adelphi, when, as was the case last year, Mr. V. W. Dale (the business manager of the E.D.A.) described the arrangements made in connection with the winter's national campaign. Mr. J. W. Beauchamp (director of the E.D.A.), was in the chair.

Mr. Dale pointed out that this year's campaign commences with a better chance of success than that of last year, because last year we were in the throes of the coal strike and the population were urged to economise in electricity, whilst there was also the possibility of the Government authorities intervening to stop the campaign. In spite of the difficulties, however, that campaign flourished, and in March last the president of the Advertising Association referred to it as the most perfect piece of organised co-operative publicity he had ever come across. The campaign left a hundred permanently established electricity circles throughout the Kingdom, 97 of which are co-operating in the new campaign.

Mr. Dale then went on to explain the various activities in connection with the campaign, the success of which, he said, was already assured. The first part of the programme concerns advertising. From the beginning of October to the middle of December, advertisements will appear in between 20 and 30 national and national provincial papers with very large circulations, and in about 200 daily and weekly papers in the smaller towns. There will be further advertising from the middle of January until the end of February, and a helpful activity will be the publication, by the E.D.A., of particulars of the advertising campaign, to enable individuals in the industry to link up their own selling efforts with the national campaign. A special series of advertisements will appear in national home papers, and there will be special advertising efforts appealing to architects and builders, an appeal to shopkeepers to utilise electricity as a means of advertising after closing hours, and it is hoped to reach from 90 to 95 per cent. of the children in the schools with a special series of 12 lessons on the applications of electricity. These will be published in a paper known to reach from 70 to 80 per cent. of teachers in elementary and secondary schools.

One object of the luncheons held throughout the country on the first day of the campaign was to enable those in the industry to get together and encourage each other, and to enlist the attention of some whose interest it would be difficult to get otherwise. A second object was to get publicity through the Press, and Mr. Dale expressed the conviction that the industry in this country would have the most wonderful Press for domestic electrical development that it had ever had.

Other sections of the campaign are concerned with the circulation of direct mail literature, and canvassing. In this connection, Mr. Dale said that although he had been a householder for fifteen years, only last week had he received his first electrical appeal through the post. It is urged that every circle should make an attempt during the campaign to carry at least one personal appeal to every potential consumer, and an appeal to existing consumers to use electricity for purposes other than those for which they use it at present. This has never been done before, and, he said, it might appeal to the industry as rather a tall order, but he did not think it was.

The giving of demonstrations is another important aspect, and 28 demonstration houses and exhibitions are being organised in different parts of the country.

Great hopes are centred in the work of the Lecture Service Panel, and Mr. Dale appealed to those in the industry to enrol themselves as willing to give popular lectures in the various localities. A number of standard lectures have been prepared by the E.D.A., dealing with various applications of electricity, for the help of lecturers. Mr. Dale suggested that it would not be difficult to introduce electrical lectures to existing local societies, such as Rotary Clubs, chambers of trade, shopkeepers' organisations, ratepayers' associations, political societies, &c., where the audiences already exist. The value to the industry of this class of work is incalculable. Some 33 electrical circles are co-operating in this work, 42 towns are already covered, and over 70 lecturers enrolled, including two chairmen of electricity committees and an assistant medical officer of health.

The National Electric Week which has been organised, from December 3rd to 10th, with the object of appealing to the public to buy electrical Christmas gifts, was also mentioned. Suggesting means by which those in the industry could help this national electric week, Mr. Dale urged them to undertake to purchase at least one electrical gift this Christmas. Manufacturers and contractors should devote some portion of their advertising to an announcement concerning that week. Supply undertakings and contractors should try to offer some special inducement to their staffs—though he was not prepared to suggest at the moment what that should be—to introduce new consumers during that period. The E.D.A. has prepared a large and attractive national window display for that week, with the object of showing the public at a glance the various purposes for which electricity is used in the home. Copies of this are available, and it is intended that it should form the centre piece in window displays and should be supplemented by saleable electrical appliances. Already more than 360 copies of this display have been ordered, and Mr. Dale expressed the hope that at least 1,000 would be used during the electrical week.

Finally, Mr. Dale raised the point as to whether the campaign was really justified, in the light of the results of the past campaigns, and answered his own question by saying emphatically that it was. Sir John Snell had said that the number of connections in the country in 1926 had increased by 15 per cent., and that the number of units sold for domestic purposes was increasing annually by 25 per cent., whilst a questionnaire circulated by Mr. Beauchamp to 150 undertakings showed that there was an increase of 20 per cent. in the number of connections made in 1926. It was the great social service which electricity was rendering, said Mr. Dale, which encouraged us to carry on this work, and the best route of appeal, in his view, was that of social service.

Discussion.

Mr. J. W. BEAUCHAMP said that it was hoped to sell at least 1,000 of the E.D.A. window displays for the national electrical week. They were selling at 35s. each, and if the E.D.A. could

not sell 1,000 throughout the British Isles this co-operative business was not worth going on with. They looked extraordinarily beautiful under coloured spot lighting, and were intended to be surrounded in shop windows, not with coils of wire and switches, but with real saleable goods marked plainly as being suitable for Christmas presents, because the people were waiting for a hint to buy such goods for presents.

Mr. H. T. Young suggested that arrangements might be made with the B.B.C. to broadcast lectures during the winter months on the many uses of electricity. It was pleasing to note, he said, that a special appeal was to be made to architects and builders, and he suggested that an appeal be made to the doctors next. He had heard recently that certain supply authorities in the country intended to supply electricity free to electrical shopkeepers during the electrical week. If others would do likewise it would help the campaign considerably, and it would not cost them very much.

Mr. R. W. Hughman pointed out that the campaign promised to be very remunerative. A point to be stressed was that this campaign differed from those of, say, benevolent institutions. Everyone in the industry who did a little extra work to help it was helping to put money into his own pocket eventually.

Mr. Hesketh made the suggestion that articles written by eminent people, such as popular actresses, and so on, dealing with the domestic applications of electricity, would be acceptable to editors of newspapers, in view of their great news value, and would help the campaign considerably.

Mrs. Bray, referring to the series of lectures which had been prepared by the E.D.A., asked if it were really possible to standardise a series of lectures to be delivered in the various districts, inasmuch as the conditions in the various localities differed. One must have regard to questions such as price, the stage at which particular supply authorities had arrived in regard to their supply, and their aim for the future.

A Speaker, who was concerned as to the attitude of architects and builders towards the wiring of new houses for domestic appliances, suggested that a great advance would be made if the people who were having houses built could be urged themselves to tackle the architects on the matter.

Mr. Leon Gaster agreed that the wireless broadcasting of lectures would be helpful, but the lectures should be delivered by people of eminence and with no axe to grind.

Mr. L. E. Buckell (G.E.C.) urged the great importance of arranging for lectures to local societies in the rural districts, but added that the lectures should be accompanied by demonstrations.

Mr. Leake referred to the misapprehension which appeared to exist amongst potential users of electricity for power purposes in regard to the prices charged for it, and suggested that if it were driven home to such people that the prices charged for electricity for power were different from the prices charged for heating, the number of power-users would increase.

Mr. Watts (Epsom) said that the tariff was the most important thing of all. At Epsom there was a fixed charge, plus 1½d. per unit for all energy consumed, and the load had increased from 2,000 to 6,000 kW in two years.

Mr. T. C. Freeth (G.E.C.) said that some householders feared that if they used electricity they would be faced with endless trouble, and would not get good service. Therefore, if more emphasis were laid on the service rendered, good results would accrue.

Mr. Dale, in his reply to the discussion, expressed the view that it would be difficult to persuade the B.B.C. to arrange for the broadcasting of lectures on the applications of electricity, however plausible the story might be. He also doubted whether the publication of articles by popular actresses, and so on, as suggested by Mr. Hesketh, would be of sufficient value to warrant the payment of the high fees which the writers of the articles might demand. It must be borne in mind that the lay Press was hungering and thirsting for electrical stories. The standardisation of a series of lectures for delivery in various parts of the country was certainly possible in his view, and those published by the E.D.A. for the use of lecturers were prepared in such a manner that they lent themselves to amplification and modification to suit local conditions. Also, when such lectures were delivered, one was justified in expecting that the chairmen could get increased value out of them by "putting across" something which was of purely local interest. Précis of the lectures were also supplied, in such a form that they could be easily absorbed by the Press.

The Chairman, discussing broadcasting, pointed out that arrangements had already been made by the B.B.C. for broadcasting six lectures, by Prof. Cramp, of Birmingham, on "A Hundred Years of Electricity." These would not deal very much with the applications, but they would be of great interest, and it was to be hoped that subsequently the B.B.C. might be persuaded to arrange for lectures on the applications of electricity.

Sir James Devonshire's Message.

The following is a copy of the National Electrical Development Message to the Press which was issued on Monday last by Sir James Devonshire, K.B.E., M.I.E.E., President of the British Electrical Development Association, and was read at all of the luncheons held on that day:—

"The time has come when every man and woman, and the children in our schools, must learn and know something more about electric power, its use and the economic basis of its production. However superficial that knowledge may be, it must be accurate.

"Last year the British Electrical Development Association, which represents the entire organised sections of British electrical industry, conducted a campaign with the object of encouraging better lighting in British homes. The success of that campaign is evidenced by the establishment of a record in the number of new electricity customers obtained throughout the country and by a marked improvement in the method and use of electric light generally.

"The Association is now inaugurating a great National Educational Campaign to cover the whole field of domestic electrification. The valuable medium of the Press will be used for advertising purposes, lectures will be delivered all over the country, demonstration electric houses and exhibitions will be organised, arrangements will be made for special show window displays, and the first National Electric Week to be held in this country will be organised during the first week of December. Postal publicity will be freely employed, and many other efforts will be made to enable the people to utilise and enjoy electric service to the fullest extent in their homes. Spread over the Kingdom the Association has more than 100 Committees working for this purpose.

"Few will dispute that the prosperity and strength of a nation must be measured to-day by the amount of electric power it employs in its industries, businesses and in the homes of its people; the position held by Britain in this respect must depend primarily on the efforts of those engaged within the industry itself.

"Speaking generally, our electricity undertakings have reached a high pitch of technical excellence; the best of them compare favourably with anything in the world, and many of the new power plants being built and planned will be the last word in efficiency, and embody striking inventions of recent years for converting the heat energy of coal into electric power in the most economical way.

"Commercially, our supply undertakings have now quite grasped the new idea that to do their duty to the public by this great national utility which they control, demands—in addition to a reasonably cheap and thoroughly reliable supply of electric power by day and night—that every class and section of the community must be taught how best to use electricity with economy for all purposes. They must also help people to get their buildings wired or acquire apparatus, and maintain it in order for them.

"Three Acts of Parliament passed since the War have done much to clear away the worst anomalies of early electrical legislation. These Acts have given us the Electricity Commission, and still later that new executive body—the Central Electricity Board, of which I have the honour to be a member. These bodies are together directing the policy and development of electricity supply, more particularly as regards the generation of electricity and its transmission throughout the country. Over a very large part of the country cheap electricity is already available. By "linking up" the more efficient generating stations, and by the provision of main transmission lines on a big scale, we are designing to reduce cost of generation and to make electricity much more widely available than it is to-day. The actual distribution or retailing of electricity will remain in the hands of the local undertakings—companies or municipal bodies—who already possess statutory powers to supply electricity. Undertakings who are relieved of the task of generating will be left with the far bigger and more responsible duty of retailing electric power on modern business lines and educating the people in its proper uses.

"The imaginative insight of the Press can be relied upon not to miss those beneficent changes in our national life which are bound to follow the general use of electricity in the home.

"Discontent is the child of drudgery and inadequate leisure—electricity removes the one and increases the other.

"In industry electric power has shown us how to avoid the worst feature of the steam age, and makes it possible to scatter our industries across the countryside, where their operations can be carried out under clean and efficient conditions. As electric power is also helping to spread our workers across the country, so electric homes will help to make those workers content with their lives and open up for them possibilities of health without isolation and interest without distraction.

"I call for 'positive action' on the part of local distributors of electricity and all others directly or indirectly connected therewith, that they should adopt a generous policy in conducting their own electrical business and in dealing with those in their territory who conduct business of any kind. I am convinced that a positive and forward commercial attitude in the whole business cannot fail to justify itself and be of enormous local benefit, while at the same time strengthening an important section of our engineering and other export business.

"Finally, it is my very pleasant duty to thank the Press of this country for the consistent help and urge which they have given freely and continuously to the cause of national electrification.

"Success to E.D.A.'s Educational Campaign!"

The Inaugural Luncheon in London.

At the London Area inaugural luncheon on Monday, Mr. A. F. Harrison occupied the chair. The company present numbered between 200 and 300, including a large number of Press editors and representatives, and representatives of various organisations connected with the electrical industry.

In a brief speech, Mr. Harrison said that he occupied the chair as chairman of the London and Home Counties Area. He referred to the extraordinary success of last year's campaign, success which came in spite of the stagnation due to

the coal dispute. He mentioned that over 40 luncheons were taking place at that moment in different parts of the country. A telegram of greetings to London had just been received from 300 "Cedac" luncheons on Tyneside, and later towards the end of the proceedings a message arrived from Manchester.

Sir James Devonshire delivered the principal speech, the chief points of which are mentioned in a leaderette elsewhere in this issue.

MR. FRANK HODGES, a member of the Electricity Board, invited to speak, emphasised the significance of the B in B.E.D.A., and urged that all should co-operate so that British electricity supply should be made at least as cheap as that of any other country in the world; then it would rest with the distributors of electricity to do their share and to combine cheapness and efficiency in conveying the benefits of electricity to their consumers. This was the most concentrated population and the most highly industrialised nation in the world, with the possible exception of Japan, and it was certain that an increased consumption of electricity per head was a vital necessity to our future prosperity. As for those who feared that cheap electricity would spell ruin to the coal and gas industries, he could assure them that they were utterly mistaken; wherever electric power gave a stimulus to industry, the consumption of coal and gas for industrial processes correspondingly increased. Even in Italy, where hydro-electric power had been rapidly developed during the last few years, the demand for coal and gas had become greater than before. There was ample scope for all three in this country.

A photograph of the gathering is reproduced in our "Notes" pages.

Campaign Publicity Matter.

The "literature" which the Association is producing for use in the campaign is of a very high grade. The electrical message is aptly conveyed, and the copious illustrations render the booklets and pamphlets real works of art. It is impossible to describe each of the publications which are now available, but we may refer to one or two. One handsome booklet deals with electric lighting, and by means of notes and illustrations shows how electricity can be used to the best advantage. The benefits of electric fires form the subject of another pamphlet, and they are contrasted with the disadvantages of coal fires. The simplicity and adaptability of electric cooking is discoursed upon in a third booklet, and a fourth illustrates the many other uses to which electricity can be put in the home. Throughout appears the slogan, "For Health's Sake Use Electricity." The larger booklets are supplemented by sixteen attractive little leaflets. Electricity suppliers, contractors, and other interested people can obtain supplies of these publications at very reasonable rates.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1926.

6,633. "Electric hammers." Central Electric Tool Co. February 1st, 1926. (Patent of addition not granted.) (265,119.)

6,735. "Sound reproducers." B. J. Grigsby and W. C. Grunow. March 10th, 1925. (249,129.)

9,074. "Triphase system for the production of very high unidirectional and continuous currents for radiology purposes." L. Gorla & Cia. Soc. Anon. April 2nd, 1925. (250,272.)

9,140. "Means for starting and synchronising of synchronous motors and rotary convertors." Harland Engineering Co., Ltd., and A. W. Maudling. April 7th, 1926. (277,046.)

9,614. "Automatic telephone exchange system." C. Gfeller Akt.-Ges. April 15th, 1925. (250,940.)

9,708. "Electrolytic cells." A. T. Stuart. June 27th, 1925. (254,268.)

9,736. "Loud-speakers." Hopkins Corporation. December 22nd, 1925. (263,481.)

11,119. "Electric power transmission." A. M. Taylor. April 28th, 1926. (Cognate applications, 1,098/27, 1,773/27, 2,471/27 2,717/27, 3,070/27, and 4,930/27.) (Patent of addition not granted.) (277,049.)

11,986. "Device for converting electric oscillations into mechanical vibrations." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). May 7th, 1926. (277,052.)

12,209. "Combined electric switches and electric couplings." J. A. Crabtree. May 12th, 1926. (277,053.)

14,112. "Protective circuits for electrical apparatus on motor and other vehicles." C. Ollier and E. Testot-Ferry. June 26th, 1925. (254,289.)

14,238. "Automatically oscillating electric fans." Veritys, Ltd., J. F. Lister, and H. W. Smallwood. June 7th, 1926. (277,072.)

14,260. "Safety devices for series-connected incandescent electric lamps." F. Eckhardt and M. Hohnekamp. June 7th, 1926. (277,073.)

14,443. "Track braking apparatus." Westinghouse Brake & Saxby Signal Co., Ltd. (Union Switch & Signal Co.). June 8th, 1926. (277,093.)

14,475. "Accumulator carriers." S. T. Hosken. June 8th, 1926. (277,096.)

14,547. "Electric motor control system." H. V. James. June 9th, 1926. (277,099.)

14,585. "Holders for thermionic valves or electron discharge tubes." General Radio Co., Ltd., and G. W. Walton. June 9th, 1926. (277,101.)

14,588. "Alternating-current rectifying devices." S. Ruben. June 9th, 1926. (Addition to 270,362.) (277,102.)

14,589. "Alternating-current rectifying devices." S. Ruben. June 9th, 1926. (Patent of addition not granted.) (277,103.)

14,658. "Electric headlamps for motor-cycles and the like." British Thomson-Houston Co., Ltd., A. P. Young and A. G. Salisbury. June 10th, 1926. (277,106.)

14,697. "Telephone systems." E. C. R. Marks (American Telechronometer Co.). June 10th, 1926. (277,115.)

14,709. "Portable wireless receiving apparatus." W. M. Rolph. June 11th, 1926. (277,116.)

14,795. "Electrical make-and-break devices." S. G. Brown. June 11th, 1926. (277,120.)

14,837. "Thermostatically-operated relays or circuit breakers." A. Reyrolle & Co., Ltd., B. H. Leeson, and T. S. Andrew. June 12th, 1926. (277,122.)

14,949. "Electron-discharge devices." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). June 12th, 1926. (Addition to 255,330.) (277,123.)

15,269. "Manufacture of carbon granules for telephone transmitters." F. O. Barralet. June 17th, 1926. (277,129.)

15,830. "Process for obtaining a uniform running-down of asynchronous motors, electrically coupled at the stator and rotor sides." Siemens-Schuckertwerke Ges. June 25th, 1925. (254,321.)

18,321. "Electric furnaces." Etablissements Sablyet. August 22nd, 1925. (257,237.)

18,827. "Installation of electric conductors in buildings." R. Grierson and Grierson, Ltd. July 28th, 1926. (277,149.)

18,968. "Electric condensers." R. H. D. Barklie. July 29th, 1926. (277,152.)

19,415. "Thermionic rectifiers." H. L. Kirke. August 5th, 1926. (277,155.)

19,745. "Electric discharge devices." British Thomson-Houston Co., Ltd. August 10th, 1925. (256,651.)

19,935. "Electrical relays." W. H. Apthorpe and Cambridge Instrument Co., Ltd. August 12th, 1926. (277,157.)

20,039. "Electric switches." General Electric Co., Ltd., A. Kinnes, and M. S. H. Hunt. August 13th, 1926. (277,158.)

20,369. "Machines for automatically slitting the base pins of electric valves and like plugging devices." British Thomson-Houston Co., Ltd., W. S. Harris, and J. Booth. August 18th, 1926. (277,161.)

20,942. "Electric accumulators." B. Heap and Chloride Electrical Storage Co., Ltd. August 19th, 1926. (277,162.)

20,614. "Electrically driven hair clippers." M. Andis. June 26th, 1926. (273,231.)

21,861. "Method of, and apparatus for increasing the amplification of electric signal impulses by regenerative means." H. F. Herbig. September 4th, 1926. (277,167.)

21,917. "Supply of high-tension current to wireless apparatus from electric supply mains." S. E. Grand. September 6th, 1926. (277,168.)

23,337. "Electric motors for operating wind-screen wipers." Powell and Hanmer, Ltd., Harris & Sheldon, Ltd., and W. J. Danial. September 22nd, 1926. (277,177.)

24,732. "Radiation of electrical energy." Dr. A. Esau. October 7th, 1925. (259,577.)

25,435. "Junction boxes for the surface wiring of electrical distributing systems." A. E. Hughes and Liverpool Electric Cable Co., Ltd. October 12th, 1926. (277,184.)

28,317. "Sound amplifiers." Columbia Graphophone Co., Ltd. (Columbia Phonograph Co., Inc.). November 10th, 1926. (277,193.)

29,494. "Motors of electric locomotives and the like." R. E. Jacobs. November 22nd, 1926. (277,198.)

30,535. "Electric condenser and methods of manufacturing the same." British Thomson-Houston Co., Ltd. December 4th, 1925. (262,443.)

30,756. "Time switches." F. E. Kewley and C. A. M. Buckley. December 4th, 1926. (277,204.)

30,998. "Apparatus for making edgewound coils." G. H. Whittingham. December 11th, 1925. (262,775.)

31,007. "Combined overload and reverse current switches." Siemens-Schuckertwerke Ges. December 8th, 1925. (262,777.)

32,363. "Thermionic amplifiers." E. H. Loftin. December 24th, 1925. (263,804.)

32,484. "Electric wind-screen wipers." R. Bosch Akt.-Ges. March 18th, 1926. (267,887.)

32,581. "Apparatus for the electromagnetic separation of ores." A. Davies. June 8th, 1926. (Divided application on 271,924.) (277,210.)

1927.

714. "Systems of electric distribution." British Thomson-Houston Co., Ltd. January 8th, 1926. (264,184.)

735. "Long-distance telephone cables." Siemens-Schuckertwerke Ges. January 11th, 1926. (264,185.)

1,956. "Control of electric motors." British Thomson-Houston Co., Ltd. January 22nd, 1926. (264,874.)

2,426. "Thermal electric switches." G. Gilliver and F. Pascall. January 27th, 1927. (277,219.)

3,989. "Regulator systems for dynamo-electric machines." British Thomson-Houston Co., Ltd. February 13th, 1926. (265,995.)

4,479. "Unidirectional electrical inductive apparatus and systems." British Thomson Houston Co., Ltd. February 18th, 1926. (266,359.)

4,605. "Writing telegraphs and like systems." J. E. Tuscher. February 23rd, 1926. (266,707.)

5,718. "Coil supports for radio purposes." K. Koch and W. Klust (trading as Dr. A. Stelling Nachf). March 2nd, 1926. (267,118.)

6,024. "Mercury-vapour lamps." W. Ulbrich. March 29th, 1926. (268,315.)

6,222. "Electron-discharge devices." British Thomson-Houston Co., Ltd. March 10th, 1926. (267,504.)

6,324. "Electrical switching mechanisms." Metropolitan-Vickers Electrical Co., Ltd. March 31st, 1926. (268,741.)

6,994. "Manufacture of electrical condensers." C. Lorenz Akt.-Ges. March 31st, 1926. (268,746.)

7,072. "Apparatus for electrolysing solutions of alkali metal chlorides." E. Krebs. March 15th, 1926. (267,560.)

7,724. "Method of, and apparatus for the manufacture of rubber goods from rubber dispersions by electrophoretic means." Anode Rubber Co., Ltd. April 14th, 1926. (267,505.)

7,917. "Electromagnetic sound reproducer." Federal Telegraph Co. January 18th, 1927. (276,900.)

8,179. "Protective systems for electric transformers." Metropolitan-Vickers Electrical Co., Ltd. March 31st, 1926. (268,766.)

8,741. "Cells with quicksilver cathodes for the decomposition of alkali metal chlorides." F. Gerlach. April 17th, 1926. (269,513.)

9,366. "Insulating stone for electric furnaces." Siemens-Elektrowarme Ges. April 6th, 1926. (269,178.)

9,817. "Super-regenerative amplifying systems." Metropolitan-Vickers Electrical Co., Ltd. April 12th, 1926. (269,207.)

10,002. "Holders for electric lamps." A. Kirk and W. G. R. Ball. April 12th, 1927. (276,914.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from September 28th:—

Orion. No. 483,506. Class 6. Vacuum cleaning machines, &c.—British Electrical and Manufacturing Co., 5-13, Clavering Place, Newcastle-on-Tyne.

Flexin. No. 483,512. Class 6. Electrode holders, being parts of machinery. No. 483,513. Class 13. Electrodes and electrode holders.—Premier Electric Welding Co., Ltd., Harrow Manorway, Abbey Wood, S.E.2.

Gramvisor. No. 483,277, and Phonovisor No. 483,278. Class 8. Apparatus for recording and reproducing views, scenes and images.—Television, Ltd., Motograph House, Upper St. Martin's Lane, W.C.2.

Minister. No. 483,553. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—Appletons, 14, Aire Street, Leeds

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ADDINGTON (Surrey).—Housing scheme, Farleigh Road; Surrey Garden Village Trust, Ltd.

BASINGSTOKE.—Business premises, Church Street, electrically equipped, for E. Brickell, baker.

BOURNEMOUTH.—Kinema, Westover Road; Seal & Hardy, architects, Yelverton Road. School, Charminster (£16,557), for the borough E.C.; F. P. Dolamore, borough engineer; Hawkins Bros., builders.

BRIGHTON.—184 houses, Moulescombe estate; Griffiths, Sons & Cromwell, Ltd. Sports ground, Moulescombe Park (£15,500); borough engineer.

BRISTOL.—Transference of works department to Brunswick Square; city engineer. Alterations, 26, College Green (£5,000); Mr. Barder.

CARNOUSTIE (Forfarshire).—Roman Catholic church; J. McGregor, architect, Arbroath.

CHELMSFORD.—Church, King's Road; Cathedral authorities. Extensions, municipal offices; borough engineer.

CHELTENHAM.—Extensions, General Hospital; Governors.

CLOWNE.—Additional housing scheme (32), for the R.D.C.; Mr. Haslam, architect.

COULSDON.—42 houses, Rickman Hill and Westleigh Avenue; H. Hemmings, Ltd.

COVENTRY.—Additional 26 houses, Radford estate, for the T.C.; borough surveyor.

CROYDON.—Block of flats and extensions to public library (£18,000), for the T.C.; borough engineer.

(Addiscombe).—44 houses, Biggin Hill Road; Thomas and Son, Bromley Avenue, Coulsdon.

(Sanderstead).—Transformer and switch house, Addington Road; County of London Electric Lighting Co.

DEWSBURY.—School, Moorlands estate, for the borough E.C.; H. Dearden, borough surveyor.

DOVER.—Extensions, Crescent House; Dover College Council. Extensions, factory, Bridge Street; H. R. Neech.

EASTBOURNE.—Extensions to boys' secondary school (£12,000), for the borough E.C.; 100 houses, Victoria Drive estate; borough engineer.

FLETTON (Peterborough).—Church (£5,000), for the Baptist trustees; Rev. H. P. Simmance, pastor.

GLASGOW.—Proposed scheme for 2,000 houses, for Corporation; Director of Housing.

GUILDFORD.—24 houses and 80 flats, Aldershot Road site; borough engineer.

HIGH WYCOMBE.—Factory extensions for G. C. Craft, Desborough Road, W. Elliss, London Road, C. P. Vine, Dashwood Avenue, and Joynson & Holland, Abercrombie Avenue.

HOVE.—Church and vicarage, Knoll estate; Chichester Diocesan Fund, Incorporated.

INVERNESS.—Housing scheme (£16,400), for the T.C.; burgh surveyor. Garage and stores (£1,750), Dempster Gardens, for A. Fraser & Co., Union Street.

LANGLEY MARISH (Bucks.).—Houses (150), New Road and Meadfield Road, for Perry Bros.

LEATHERHEAD.—Additional housing scheme (25), for the U.D.C.; surveyor.

LEEDS.—Conversion of Hanover Wesleyan Church into gramophone factory, for Messrs. Appletons, Aire Street.

LEICESTER.—Orthopædic clinic; city engineer. Adaptation, Bistall Holt, for mental defectives; city engineer. Art rooms, Newark secondary school; Smith & Hutchinson, Ltd. 240 houses, Gipsy Lane, &c.; Sutton trustees.

LITTLE STANMORE.—22 houses; Franklin & Co., Erith.

LLANELLY.—Conversion of premises, Vaughan Street, into bazaar, for F. W. Woolworth & Co., Ltd., Kingsway, London.

LONDON (Barkingside, E.).—Church, school and presbytery, Cranbrook Road, for the Roman Catholic church; priest-in-charge.

(Becontree, E.).—School (350 places), for the Roman Catholic managers; Very Rev. Canon Palmer.

LONDON (cont.)

(East Ham, E.).—Tenements, Flanders estate; borough engineer. Alterations, 809-813, Romford Road; F. W. Woolworth, Ltd.

(Finchley, N.).—Adaptation, old school buildings for gymnasium and workshops, Christ's College; governors.

(Golder's Green, N.W.).—Church, St. Albans parish; Rev. Herbert Trundle.

(Battersea, S.W.).—Lead mills, York Road; J. W. Falkner & Sons. Extensions, 44-48, Lavender Hill; T. Jay Evans & Son.

(Holland Park, W.).—Flats at railway station; Railway Co.

(Kensington, S.W.).—Jewish school, Lancaster Road; Hebrew community. Extension of Town Hall and Central public library; borough surveyor.

(Wimbledon, S.W.).—Reinstatement of premises for J. W. Coote & Co., house furnishers, 60, High Street.

MAIDSTONE.—Houses (34), Palmar Road and Hyde Road, for Cox Bros.

MALVERN.—Conversion of old Council offices for weights and measures department; T. Broad, Ltd.

MANCHESTER.—Exhibition hall, Alexandra Park site; city architect.

MYTHOLMROYD (Yorks.).—Electric lighting installation, St. Michael's Church; Rev. R. V. Sellers, M.A., vicar.

NEW MALDEN.—Church (£15,000), for Kingston-on-Thames Wesleyan Circuit; P. Rampton, secretary.

NORTHAMPTON.—460 houses, St. David's estate; borough engineer.

NORTHERN IRELAND (Cavan).—Electric wiring, supply and erection of fittings and lamps in Court-house, for the C.C.: P. O'Reilly, secretary, C.C., Court-house.

Bangor (Co. Down).—Central school (£40,000); Co. Down Regional Education Committee.

NOTTINGHAM.—Extension of nurses' home, Bogthorpe Infirmary, Hucknall Road; Starr & Hall, 12, Victoria Street, architects.

PERSHORE.—Housing scheme (36), for the R.D.C.; surveyor.

PLYMOUTH.—134 houses, St. Budeaux, for the Devonport Dockyard Employés' Housing Association; H. J. Hammick, 7, Cornwall Street.

RHYL.—Additional housing scheme (48), for the T.C.; borough surveyor.

RICHMOND (Yorks.).—Development of Bainesse estate for residences, for F. Coates; Wetherell & Dent, architects.

ROTHWELL.—Rothwell and Oulton-with-Woodlesford sewage disposal works, including three pumping stations; Willcox & Raikes, engineers, 63, Temple Row, Birmingham.

ST. ALBANS.—Housing scheme (35), for the T.C.; F. T. Negus, city engineer.

SALFORD.—School, Lower Kersal (£22,000), for the borough E.C.; Fearnley & Sons, Ltd., builders.

SELSDON (Surrey).—40 houses, Farleigh and other roads; E. C. Astington. Church and hall, Addington Road; London Baptist Association.

SHIPLEY.—Municipal office accommodation; U.D.C. committee.

SHIRLEY.—64 houses, Nursery Close; P. Richardson.

SOUTHPORT.—Works, Scarth Hill, including engine house, pumping plant, &c. (£13,000), for the Water Board; engineer. School, Birkdale, for the borough E.C.; J. Ernest Jarratt, clerk.

SWADLINCOTE.—Block of business premises, Lower Midway, for the Burton-on-Trent Co-operative Society; secretary.

THORNTON HEATH.—Church and parish hall, Green Lane; vicar of St. Paul's.

TYNEMOUTH.—Sanitary block, Infirmary; W. Stockdale, architect. 48 houses, Cullercoats estate; borough engineer.

WARRINGTON.—Completion of 86 houses, for Corporation; D. Cooper. Hall, Buttermarket Street; Salvation Army. Additions, moulding shops, Dallam Lane; Whyman's Foundry, Ltd.